

## **E           Appendix E: Traffic Studies**

- E.1   Traffic Impact Study for Alternative A
- E.2   Traffic Impact Study for Alternative B
- E.3   NCDOT Traffic Impact Analysis Review Report

E.1 Traffic Impact Study for Alternative A

# U.S. Department of Veterans Affairs



## TRAFFIC IMPACT STUDY FOR THE RALEIGH OUTPATIENT CLINIC – ALTERNATIVE A WAKE COUNTY, NORTH CAROLINA

July 2020

**Contract Number:** GS-10F-0360T **Order Number:** 36C10F20F0039

**Prepared for:**

U.S. Department of Veterans Affairs  
Office of Construction and Facilities Management

**Prepared by:**

EPR  
902 E Jefferson St, Suite 101  
Charlottesville, VA 22902  
(434) 202-5082  
[www.epr-pc.com](http://www.epr-pc.com)

Under Subcontract to:

LRS Federal LLC  
565 Benfield Blvd, Suite 400  
Severna Park, MD 21146  
(443) 760-4460  
[www.lrsfederal.com](http://www.lrsfederal.com)

## TABLE OF CONTENTS

1.0	Project Overview
2.0	Project Area
3.0	Future Year Traffic Volumes
4.0	Intersection Capacity Analyses
5.0	Summary of Impacts and Mitigation

## LIST OF FIGURES

Figure 1A-C	Vicinity Maps
Figure 1D	Site Access Concept
Figure 2A	Existing Peak Hour Volumes (Various Years)
Figure 2B	Existing 2020 Factored Peak Hour Volumes
Figure 3A	Background Year 2024 Peak Hour Volumes
Figure 3B	Approved Project Trips
Figure 3C	No Build 2024 Peak Hour Volumes
Figure 4	Site Trips
Figure 5	Build 2024 Volumes
Figure 6	Existing LOS
Figure 7	No Build LOS
Figure 8	Build LOS
Figure 9	Build Mitigated LOS

## LIST OF TABLES

Table 1	Proposed Site Trip Generation
Table 2	LOS & Delay Thresholds
Table 3	Delay, LOS and Queue Summary (Existing, No Build and Build Comparison)
Table 4	Delay, LOS and Queue Summary (Build and Build Mitigated Comparison)

## TECHNICAL APPENDICES

Appendix A	Memorandum of Understanding
Appendix B	Traffic Data Methodology Memorandum
Appendix C	Count Data Provided by NCDOT / Town of Garner
Appendix D	Count Data (Collected in May 2020)
Appendix E	Trip Generation and Distribution Methodology Memorandum
Appendix F	Intersection Capacity Analysis Synchro Worksheets – Existing
Appendix G	Intersection Capacity Analysis Synchro Worksheets – No Build
Appendix H	Intersection Capacity Analysis Synchro Worksheets – Build
Appendix I	Intersection Capacity Analysis Synchro Worksheets – Build Mitigated

## **1.0 PROJECT OVERVIEW**

### **Purpose**

The United States Department of Veterans Affairs (VA) is proposing to construct an outpatient facility in Wake County, North Carolina. The project consists of two build alternatives and one no-build alternative currently under consideration. Alternative A is located southwest of the intersection of Rand Road and Benson Road, and is the subject of this traffic study. Alternative B is evaluated in a separate traffic study. The following Traffic Impact Study has been prepared to assist in the preparation of an Environmental Assessment (EA) document for the purposes of the National Environmental Policy Act (NEPA). This study will identify any traffic impacts of the proposed development compared to the no build scenario and if any exist, identify potential improvement measures to mitigate the impacts.

### **Proposed Site**

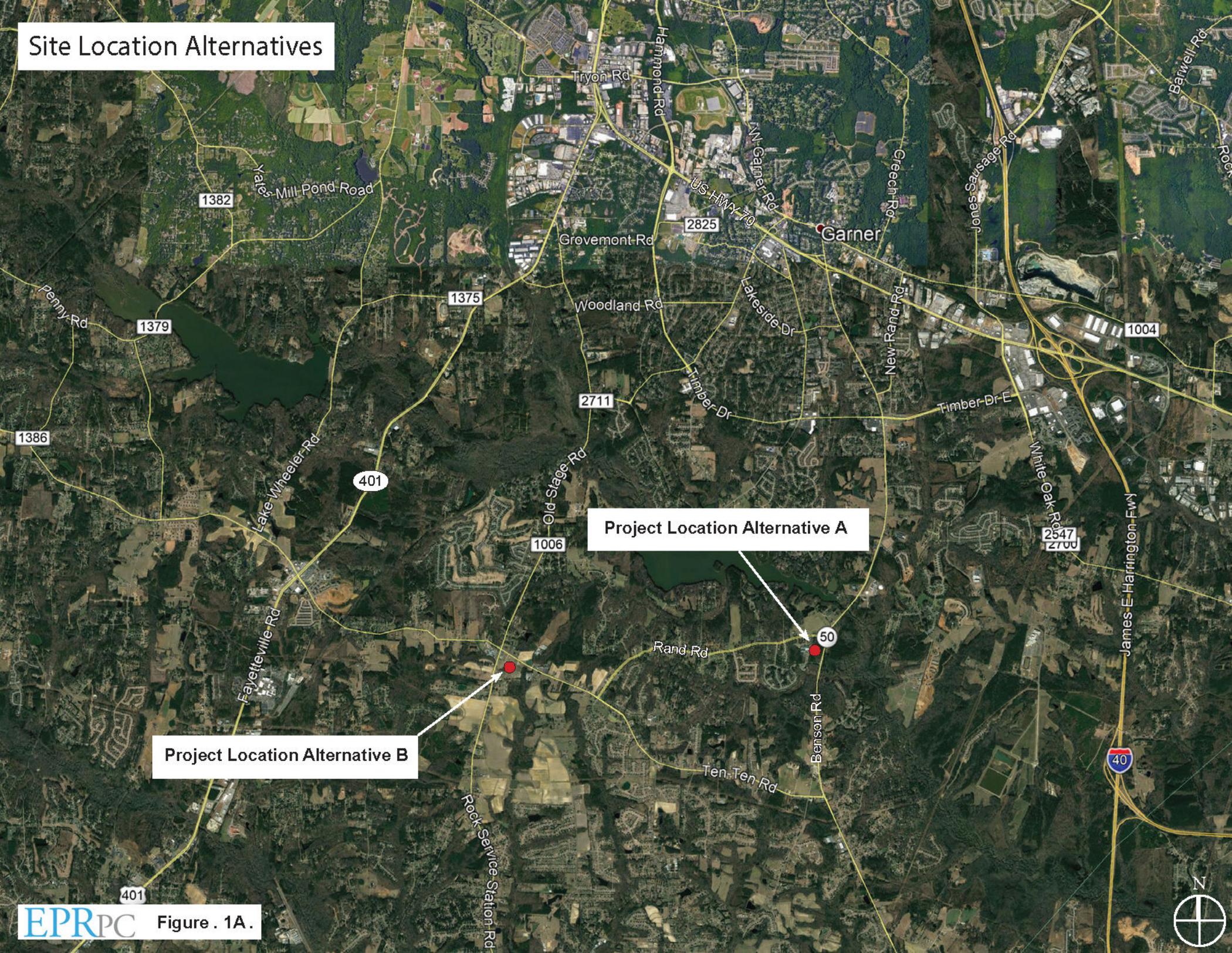
The proposed site is located southwest of the intersection of Rand Road and Benson Road, north of Arbor Greene Drive. Figures 1A-C illustrate the vicinity of the proposed site. Figure 1D illustrates a conceptual layout of the site access points. Site plans are not available, but Figure 1D represents the access scenario evaluated in this study. While this might not represent the final conceptual design, the purpose of this study is to determine if there is a development scenario that may be built without negatively impacting traffic operations compared to the no build scenario.

The planned VA Outpatient Clinic is proposed to have 222,325 square feet of space with 1,300 parking spaces. The clinic is expected to have 350-400 employees and serve approximately 500 patients per day. The Alternative A site is approximately 16.76 acres based on GIS data.

### **Consultation**

There were various meetings and consultations with NCDOT and Town of Garner staff to identify the various technical methodologies and assumptions. These consultations included a scoping meeting to identify the scope of work and primary methodologies, as well as additional, specific consultations regarding traffic data, trip generation, and trip distribution. These consultations are referenced in the appropriate sections of this document and the resulting memoranda are provided in the technical appendices as referenced in the document.

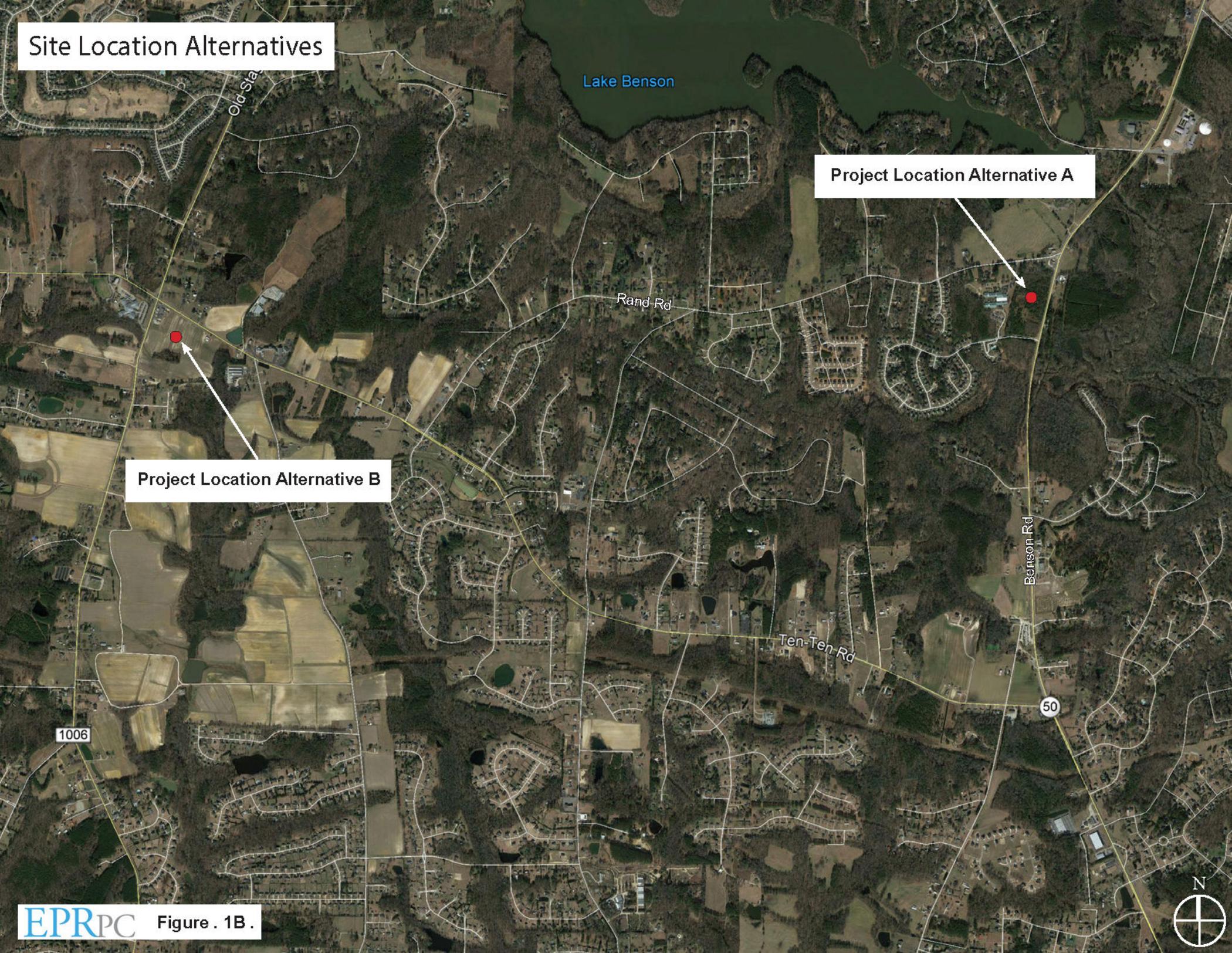
# Site Location Alternatives



Project Location Alternative A

Project Location Alternative B

# Site Location Alternatives



Project Location Alternative A

Project Location Alternative B

Lake Benson

Rand Rd

Ten-Ten Rd

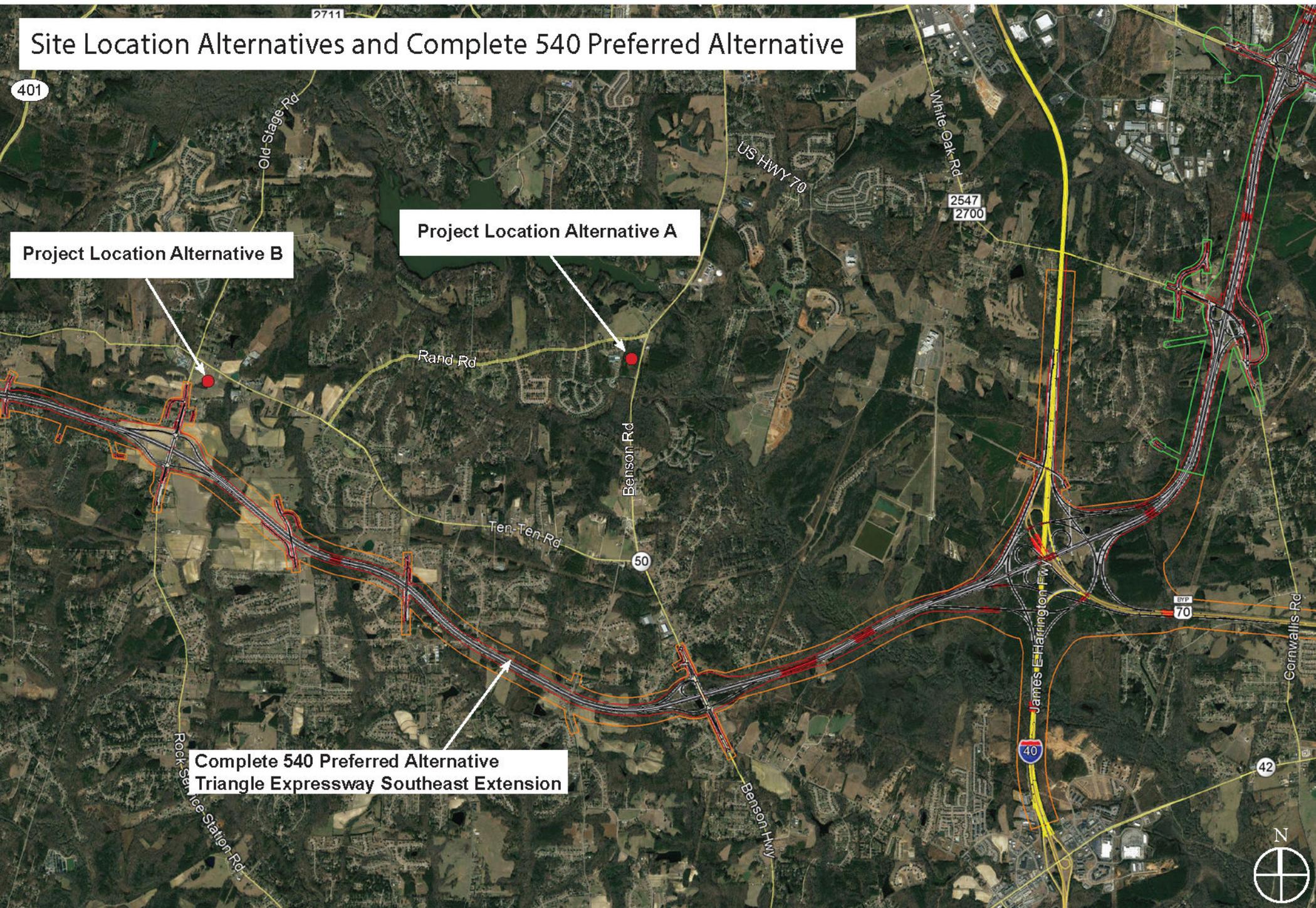
Benson Rd

1006

50



# Site Location Alternatives and Complete 540 Preferred Alternative

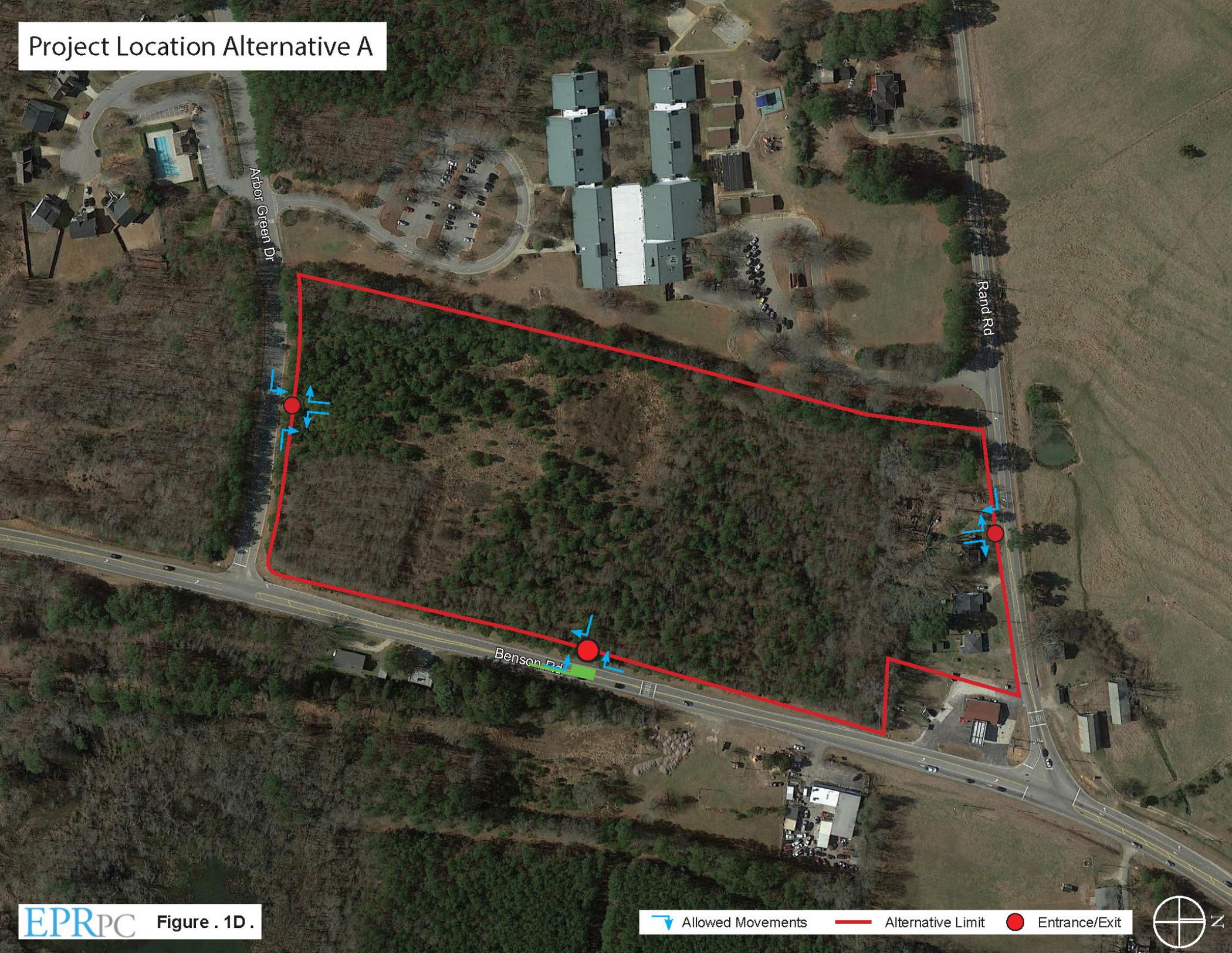


Project Location Alternative B

Project Location Alternative A

Complete 540 Preferred Alternative  
Triangle Expressway Southeast Extension

# Project Location Alternative A



EPRPC Figure 1D.

Allowed Movements    Alternative Limit    Entrance/Exit



## **2.0 PROJECT AREA**

The Memorandum of Understanding that resulted from a traffic study scoping meeting with representatives from North Carolina Department of Transportation (NCDOT) and the Town of Garner is provided in Appendix A.

As a result of that meeting, the following traffic study locations were identified as the study area:

- Benson Road and Timber Drive – signalized
- Benson Road and Rand Road – signalized
- Benson Road and Arbor Greene Drive – unsignalized
- Benson Road and Cleveland School Road – signalized
- Site access locations – unsignalized

Benson Road (Route 50) is generally a two lane undivided arterial that parallels I-40 through the study area. At the northern end of the study area near Timber Drive, the corridor connects to more commercial uses and the speed limit is 45 miles per hour (mph). Traversing south, the corridor character becomes more suburban / rural and the speed limit increases to 50mph and then 55 mph.

Timber Drive is primarily a four lane divided arterial that connects to major commercial areas just east of the study area as well as ultimately to I-40. The Benson Road and Timber Drive signalized intersection is mostly built out with two through lanes on all approaches except northbound and most turns served with exclusive turn lanes.

Rand Road is primarily a two lane, undivided, collector road that connects Benson Road with Ten Ten Road. The Benson Road and Rand Road signalized intersection includes exclusive eastbound lanes, an exclusive southbound right turn lane and an exclusive northbound left turn lane.

Arbor Greene Drive is a two lane, undivided, low volume road that primarily serves residential uses. The Benson Road and Arbor Greene Drive unsignalized intersection includes exclusive eastbound lanes, an exclusive southbound right turn lane and an exclusive northbound left turn lane.

Cleveland School Road is a two lane, undivided facility that provides a shorter connection from Benson Road to the commercial areas at Route 42 and ultimately to I-40. The Benson Road and Cleveland School Road signalized intersection includes exclusive left turn lanes from Benson Road and an exclusive westbound right turn lane.

The existing geometry at the study intersections is illustrated in the existing volume figures (Figures 2A and 2B).

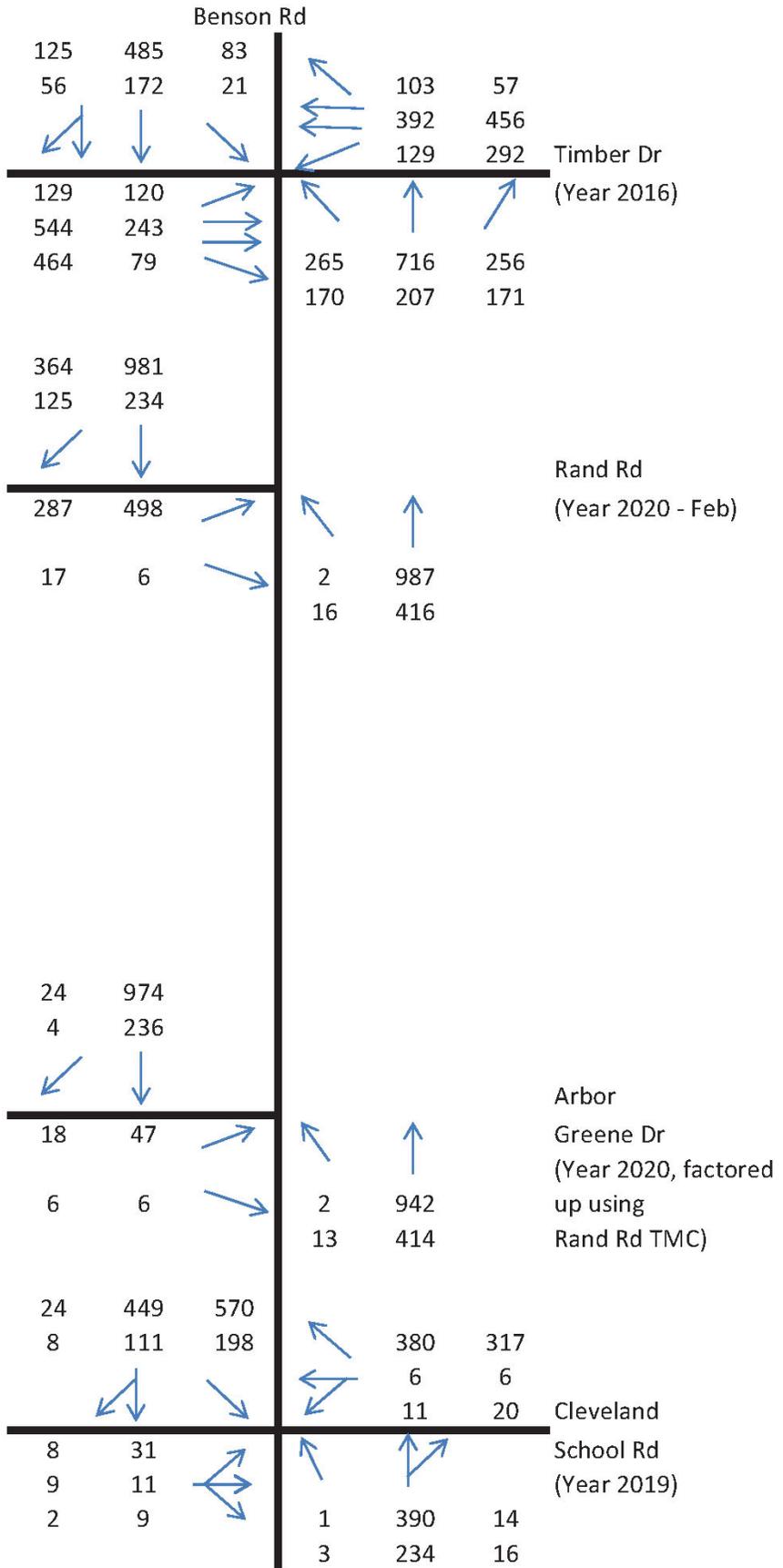
### **Existing Traffic Volumes**

With the pandemic impact to typical traffic volumes, obtaining traffic volume data for the study required a detailed process. The methodology was documented in a separate memorandum

provided in Appendix B. Count data provided by NCDOT / Town of Garner is provided in Appendix C. Count data that was field collected specifically for this study is provided in Appendix D.

Figure 2A illustrates the existing peak hour count data as provided or collected. Note that only the Rand Road intersection data is from 2020 pre-pandemic. The Timber Drive intersection and Cleveland School Road intersection data are from previous years. The Arbor Greene intersection was counted in May 2020, but represents post-pandemic traffic. Figure 2B illustrates the year 2020 existing volumes utilized for the study. See the memorandum in Appendix B for a detailed description of this methodology.

FIGURE 2A  
 EXISTING (VARIOUS YEARS)  
 PEAK HOUR VOLUMES

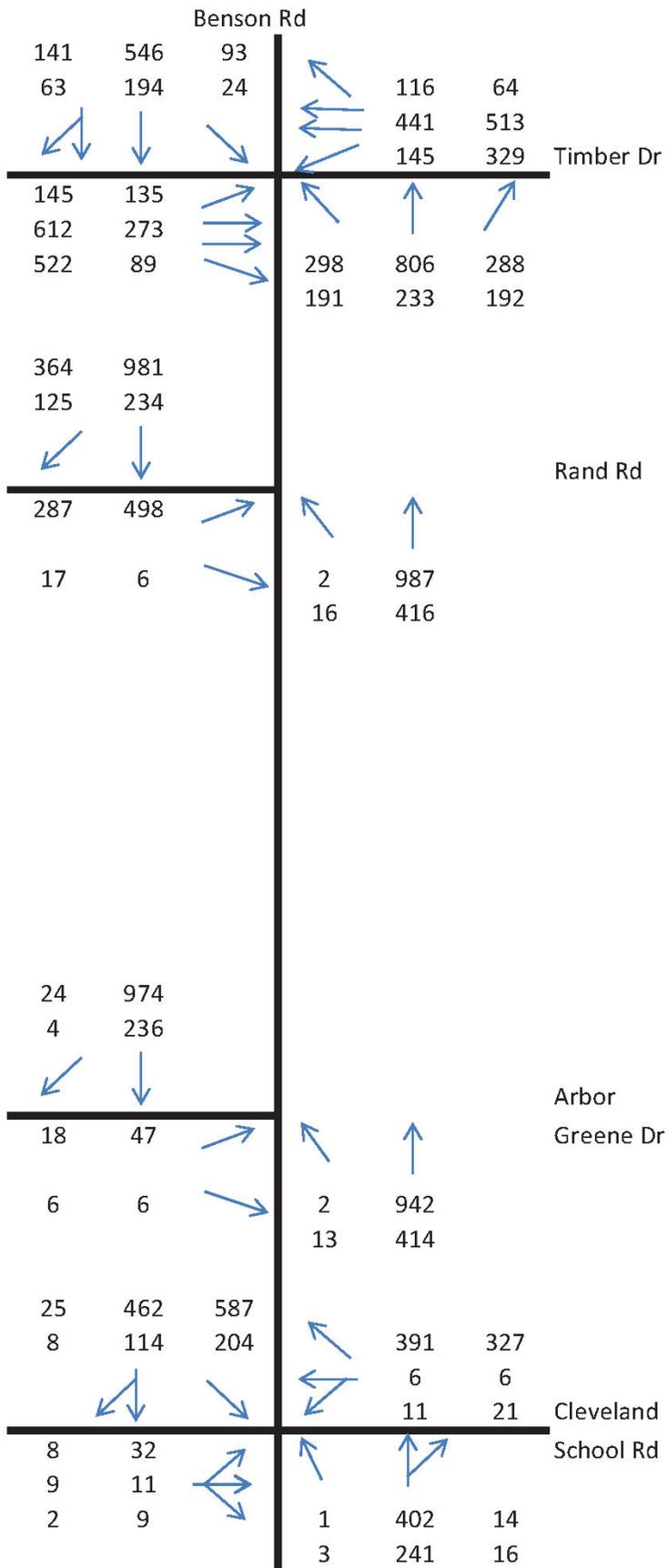


PROPOSED SITE

LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage

FIGURE 2B  
 EXISTING - FACTORED TO YEAR 2020  
 PEAK HOUR VOLUMES

Note  
 Volumes increased by  
 3% per year to year 2020  
 as necessary



PROPOSED  
 SITE

LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage

### 3.0 FUTURE YEAR TRAFFIC VOLUMES

#### Background Traffic

It is assumed that the clinic will be operational by 2024. A standard three percent growth rate was utilized to determine the background traffic volume. The resulting 2024 background traffic volumes are illustrated in Figure 3A.

#### Online Traffic (Approved Developments Not Yet Constructed)

There is one nearby development (Circle K) that has been approved but not yet completed that will be evaluated as an online project. The associated site trips will be added directly to the study area network in addition to the general background traffic growth.

Town of Garner staff provided the traffic study for the Circle K development at the Benson Road and Cleveland School Road intersection. The related traffic volumes are illustrated in Figure 3B. The combined background traffic plus the online traffic results in the total no build volumes illustrated in Figure 3C.

#### Proposed Site Trip Generation

The VA does not have specific trip generation data for their outpatient clinics. As the *ITE Trip Generation Manual* does not provide ideally compatible data, an alternative methodology was documented in a separate memorandum provided in Appendix E. The summary is that the ITE code clinic based on employees is utilized with the exception of PM peak out. For the PM peak out value, the ITE generated clinic volume (218) was increased to 276 so that the PM peak out volume is 80 percent of the AM peak in volume. This ratio matches the clinic use based on square feet and provides a more conservative volume. The trip generation is summarized in Table 1.

**TABLE 1**  
**Site Generated Traffic**  
**(Vehicles Per Hour)**

USE	ITE CODE	ADT	AM PEAK		PM PEAK	
			IN	OUT	IN	OUT
Clinic (based on employees - 400)	630	3700	345	103	122	276*

Source: ITE Trip Generation Manual 10<sup>th</sup> Edition (\*except PM Peak Out)

ADT – Annual Daily Traffic, other volumes are vehicles per hour

#### Traffic Distribution

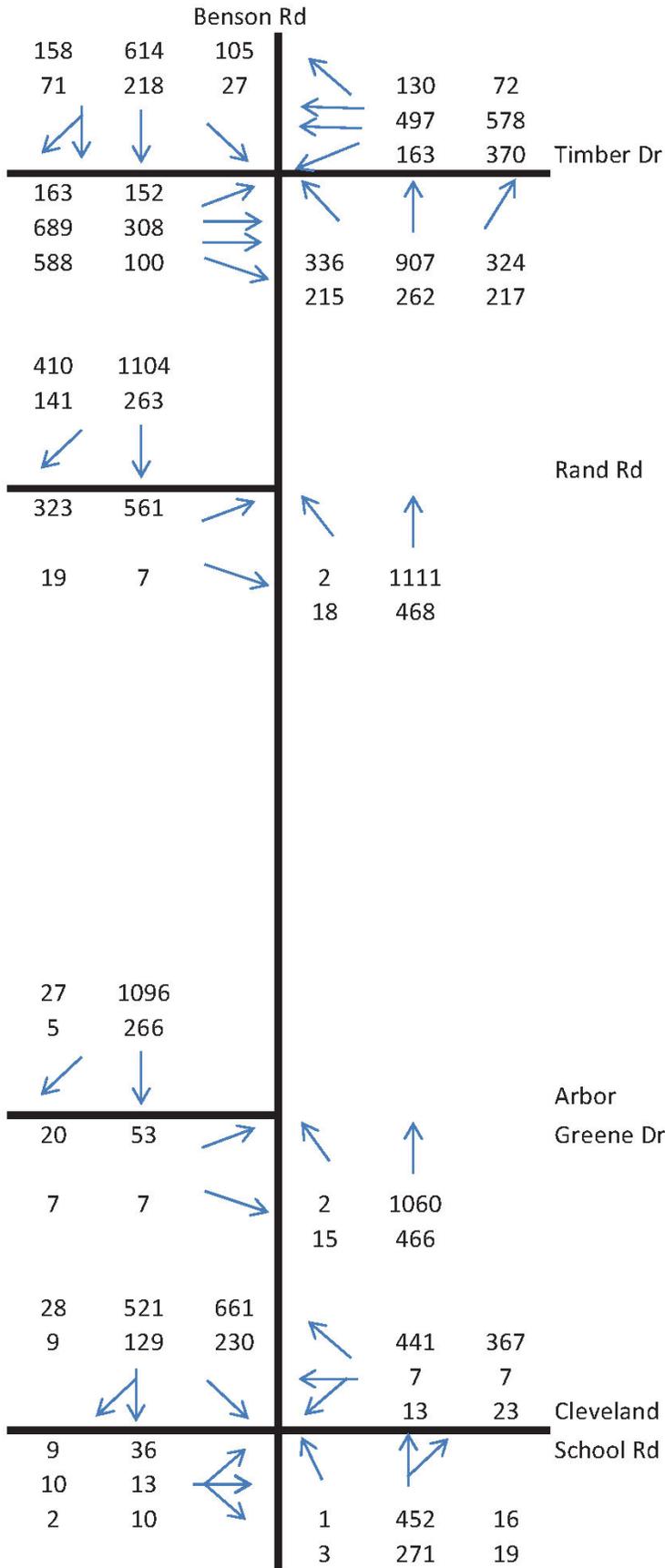
The general traffic distribution was also discussed during the traffic study scoping meeting. The final distribution was referenced in the memorandum provided in Appendix E. The site trips, distribution percentages, and resulting site trips are illustrated in Figure 4.

#### Build Year 2024 Traffic Volumes

The no build volumes and site trip volumes combine to generate the total build (year 2024) volumes. These volumes are illustrated in Figure 5.

FIGURE 3A  
 BACKGROUND 2024  
 PEAK HOUR VOLUMES

Note  
 Volumes increased by  
 3% per year



PROPOSED  
 SITE

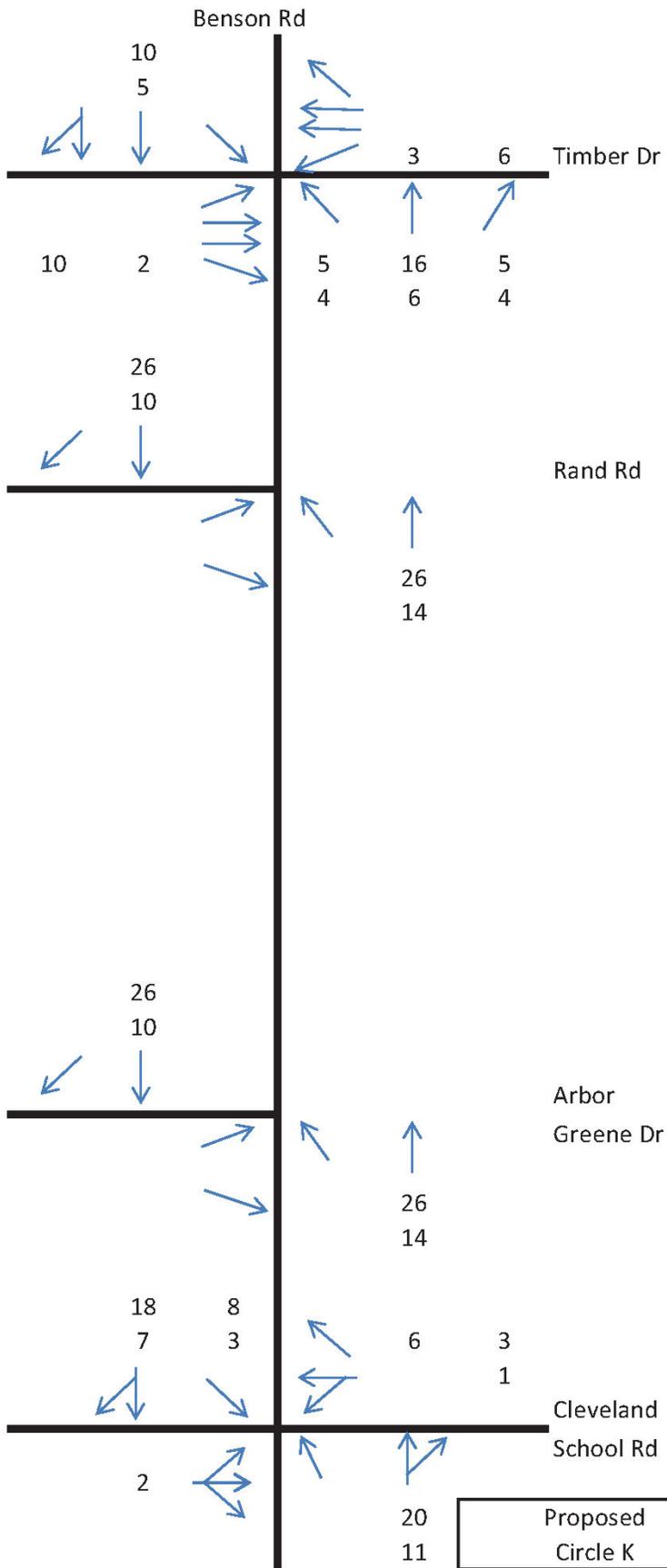
LEGEND  
 123 PM → 52 AM  
 (closest to the arrow is AM)  
 Arrows represent laneage

FIGURE 3B  
 ONLINE DEVELOPMENT  
 CIRCLE K (BENSON RD AND CLEVELAND SCHOOL RD)  
 PEAK HOUR VOLUMES

Notes

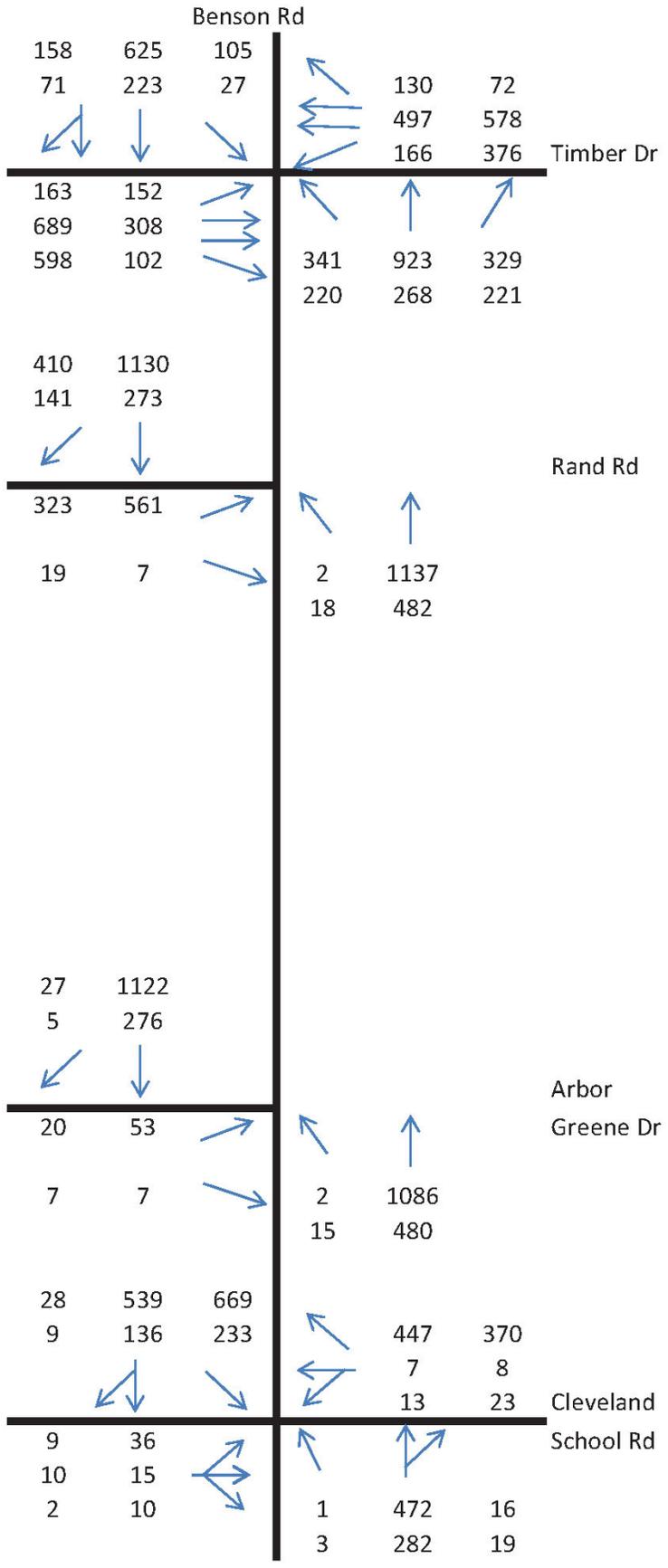
- Assumed trips along Benson Rd went all the way to Timber Dr
- At Timber Dr, distributed turns based on existing percentages

PROPOSED  
SITE



LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage

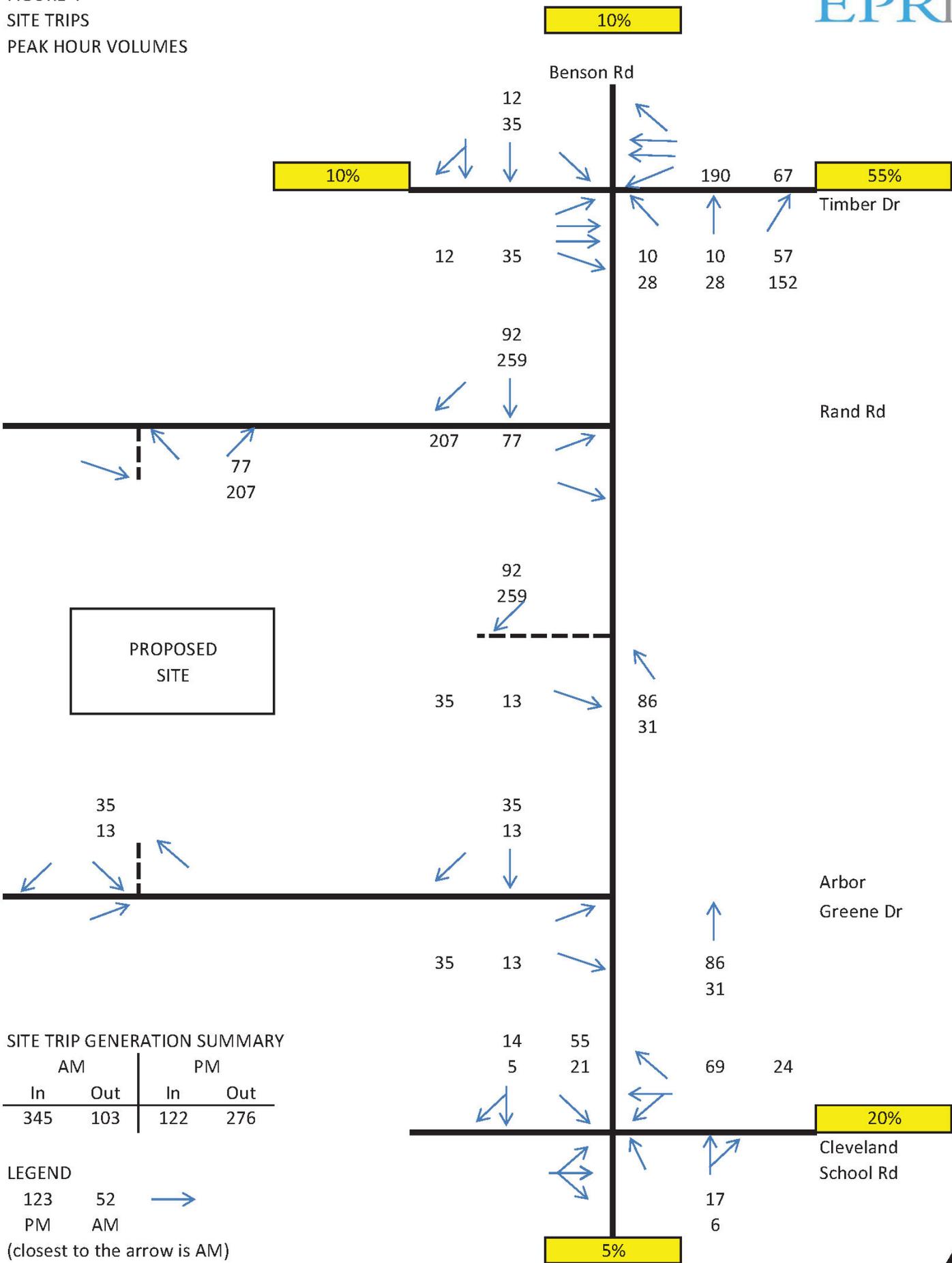
FIGURE 3C  
 NO BUILD 2024 (TOTAL BACKGROUND + APPROVED DEVELOPMENT)  
 PEAK HOUR VOLUMES



PROPOSED  
SITE

LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage

FIGURE 4  
SITE TRIPS  
PEAK HOUR VOLUMES

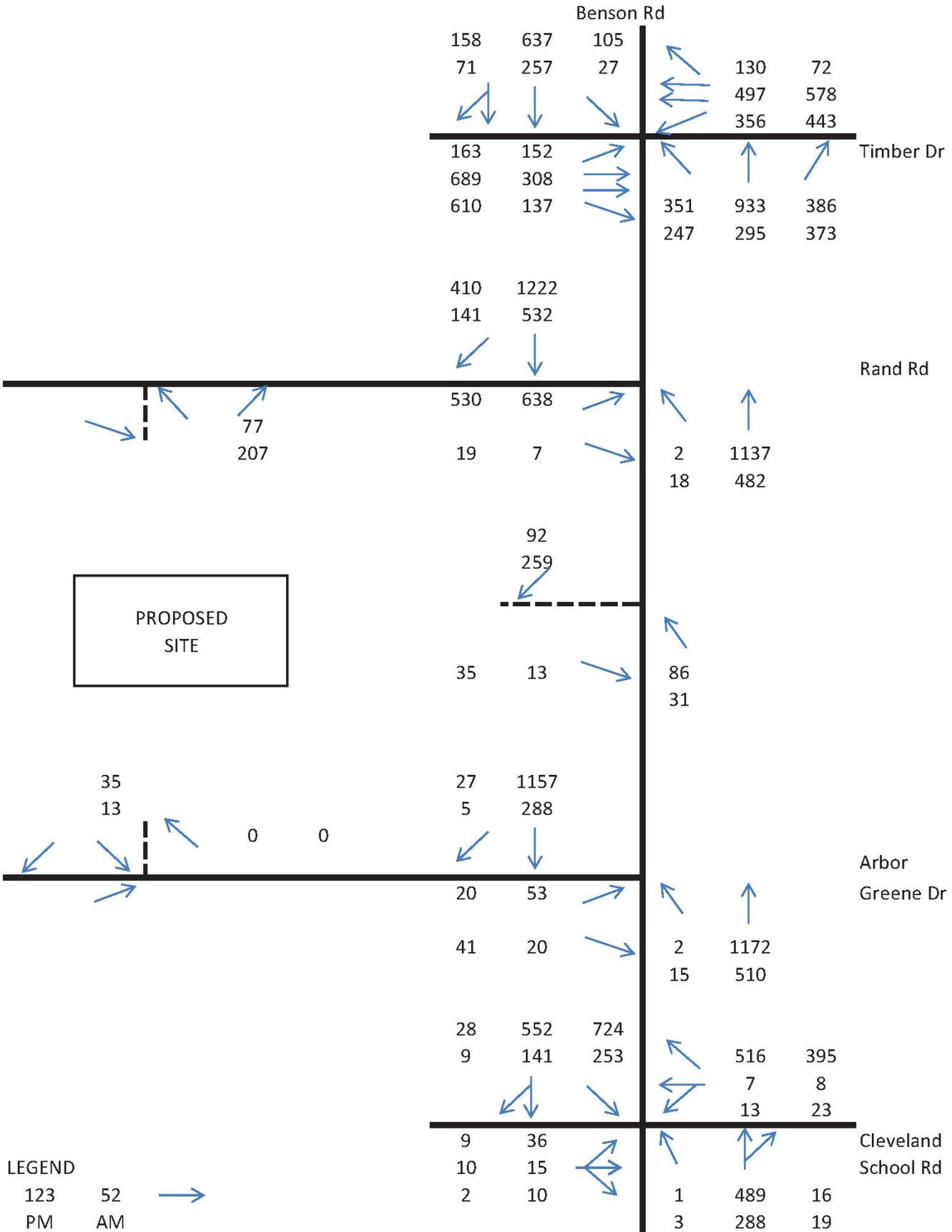


SITE TRIP GENERATION SUMMARY

AM		PM	
In	Out	In	Out
345	103	122	276

LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage  
 Access locations

FIGURE 5  
 BUILD 2024  
 PEAK HOUR VOLUMES



## 4.0 INTERSECTION CAPACITY ANALYSES

### Methodology

The intersection capacity analyses were performed using Synchro (version 9) per the methodology documented in the Highway Capacity Manual (HCM) (Transportation Research Board). The HCM based calculations are provided in this report, except when HCM limitations do not provide for a calculation, and Synchro values are provided.

Typically, actual peak hour factor (PHF) and truck percentage (HV%) data calculated from the manual turning movement count (TMC) is utilized for capacity analysis. However, as a result of the alternative methods required to obtain and derive existing traffic count data (described in Appendix B), NCDOT standard defaults were utilized. Also, the signal plan for the Benson Road and Timber Drive intersection was obtained from a development traffic study so that timing data was utilized for existing conditions analysis. However, signal timing information for the remaining signalized study intersections was not provided, so NCDOT standard defaults were utilized.

Capacity analyses are utilized to determine a Level of Service (LOS) for a given intersection operating under either signalized or unsignalized control. The LOS is based on estimated delay and range from LOS A, the best, to LOS F, the worst. In general LOS A and LOS B indicate little or no delay, LOS C indicates average delay, LOS D indicates delay is increasing and noticeable, LOS E indicates the limit of acceptable delay and F is characteristic of over saturated conditions. The actual delays associated with these levels of service are identified in Table 2.

**TABLE 2**  
**LOS and Delay Thresholds**

<b>LOS</b>	<b>UNSIGNALIZED INT. DELAY (secs)</b>	<b>SIGNALIZED INT. DELAY (secs)</b>
A	0 – 10	< 10
B	> 10 – 15	> 10 – 20
C	> 15 – 25	> 20 – 35
D	> 25 – 35	> 35 – 55
E	> 35 – 50	> 55 – 80
F	> 50	> 80

Source: Highway Capacity Manual

The analysis results (delay, LOS and 95<sup>th</sup> percentile queue) are summarized in Table 3 (comparing existing, no build and build) and Table 4 (comparing build to build mitigated). The results are also illustrated in Figures 6-9 (existing, no build, build and build mitigated respectively). The HCM based intersection capacity analysis worksheets from Synchro are provided in the appendix. The existing scenario is located in Appendix F, the no build is in Appendix G, the build is in Appendix H, and the mitigated build scenario is in Appendix I.

## **Study Intersections**

### *Benson Road and Timber Drive - Signalized*

The Benson Road and Timber Drive intersection analysis indicates operational issues in the existing and no build scenarios, with several movements operating at unsatisfactory levels of service (LOS E and LOS F). With the intersection already projected to operate unsatisfactorily in the no build condition, the build condition analysis projects minimal change. There are several individual movements similarly projected to operate at LOS E / LOS F, with an overall intersection level of service of LOS E like the no build PM condition.

Although the operational issues are related to existing and background volume growth, mitigation testing was conducted to determine what improvements would effectively improve operations. Given the no build operational issues, substantial improvements are required to improve operations. The improvements tested are adding a second northbound left turn lane, adding a second westbound left turn lane and adding a second northbound thru lane (shared with the right turn movement). Combined, these improvements result in satisfactory operational improvements.

### *Benson Road and Rand Road - Signalized*

The Benson Road and Rand Road intersection analysis indicates operational issues in the existing and no build scenarios, with several movements operating at unsatisfactory levels of service (LOS E and LOS F). As the site trip distribution utilizes this intersection, especially for egress (left turn from Rand Road onto Benson Road), as expected, the build scenario results in additional operational issues. Therefore, a mitigation scenario that includes a second eastbound left turn lane (shared with the right turn movement) was evaluated. Given this mitigated improvement scenario, each individual movement is expected to operate at LOS D or better during the AM peak hour, and each individual movement is expected to operate at LOS D or better during the PM peak hour with one exception. The southbound through movement is projected to operate at a level of delay 3.7 seconds over the LOS D threshold.

### *Benson Road and Arbor Greene Drive - Unsignalized*

The Benson Road and Arbor Greene Drive intersection analysis indicates operational issues in the existing and no build scenarios, with the eastbound left turn movement operating at unsatisfactory levels of service (LOS E and LOS F). With the intersection already projected to operate unsatisfactorily in the no build condition, the build condition analysis projects minimal change. The same unsatisfactory levels of service are projected, and the build scenario is expected to add less than one vehicle to the 95th percentile queue to the eastbound left turn movement.

Although the operational issues are related to existing and background volume growth, mitigation strategies were considered to improve operations. Even though the side street volume is very low at this intersection, the Benson Road traffic volume does not allow for enough gaps for the eastbound left turn movement to operate at a satisfactory level of service. Given the low side street volume, traffic signalization is not warranted and typical roundabout volume criteria are not met. The only potential mitigation strategy is to eliminate the eastbound left turn movement. This strategy was not evaluated further as the proposed site trip distribution does not utilize this movement.

*Benson Road and Cleveland School Road - Signalized*

The Benson Road and Cleveland School Road intersection analysis indicates the intersection operates satisfactorily and will continue to do so through the build scenario, with all individual movements operating at LOS D or better.

As the intersection is expected to operate satisfactorily, mitigation measures were not evaluated. However, one operational safety improvement was modeled. Given the high volume, the southbound left turn movement was modeled as a protected phase only.

**Access Locations**

*Rand Road Access*

The Rand Road Access location was modeled as right in only ingress and full egress allowed. The ingress right turn is shared.

*Benson Road Access*

The Benson Road access was modeled as right out only egress and full ingress allowed. The ingress includes exclusive right turn and left turn lanes (200' storage).

*Arbor Greene Drive Access*

The Arbor Greene Drive access was modeled as full access. The ingress includes an exclusive right turn lane (150' storage).

FIGURE 6  
EXISTING  
LOS SUMMARY

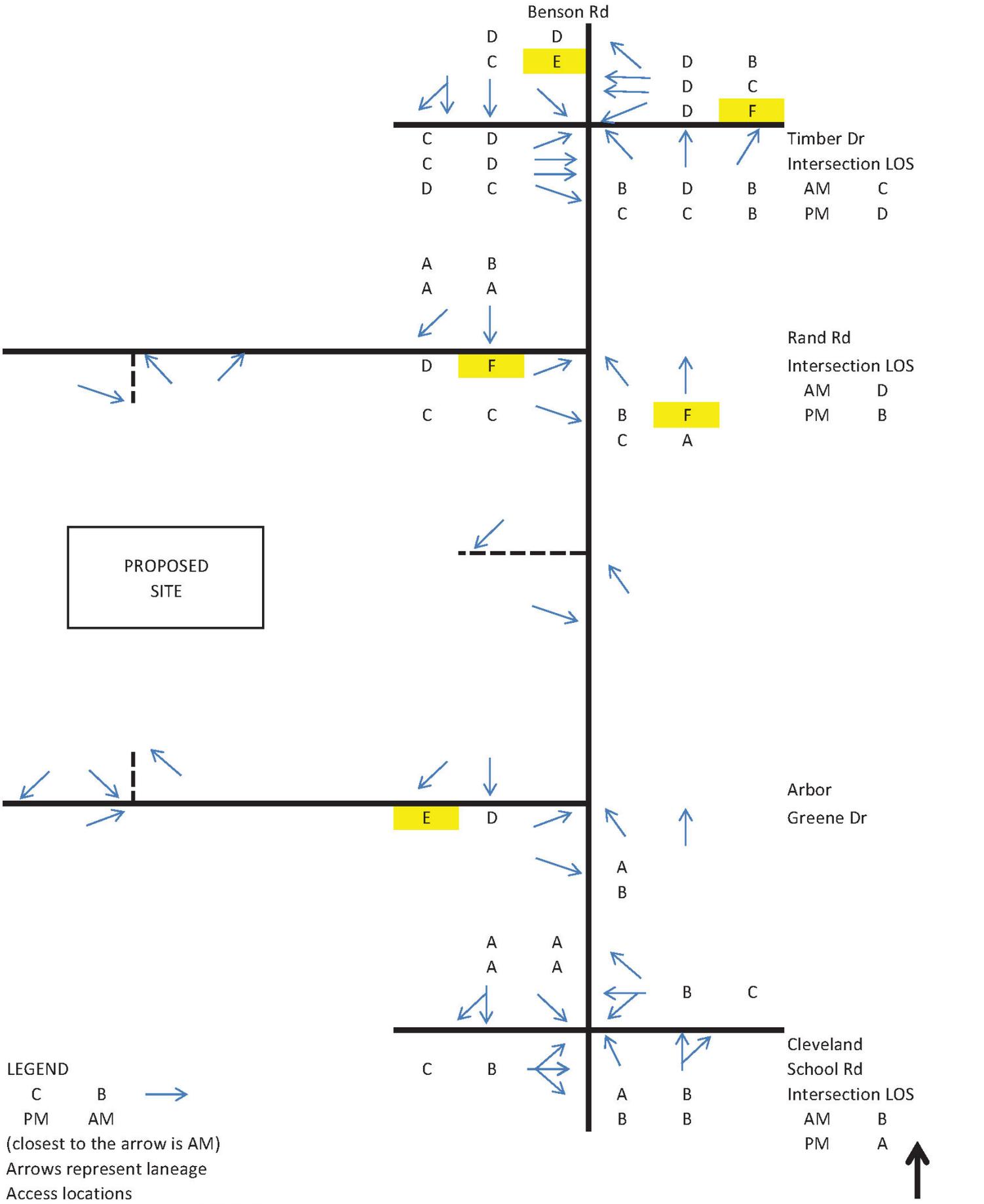


FIGURE 7  
NO BUILD  
LOS SUMMARY

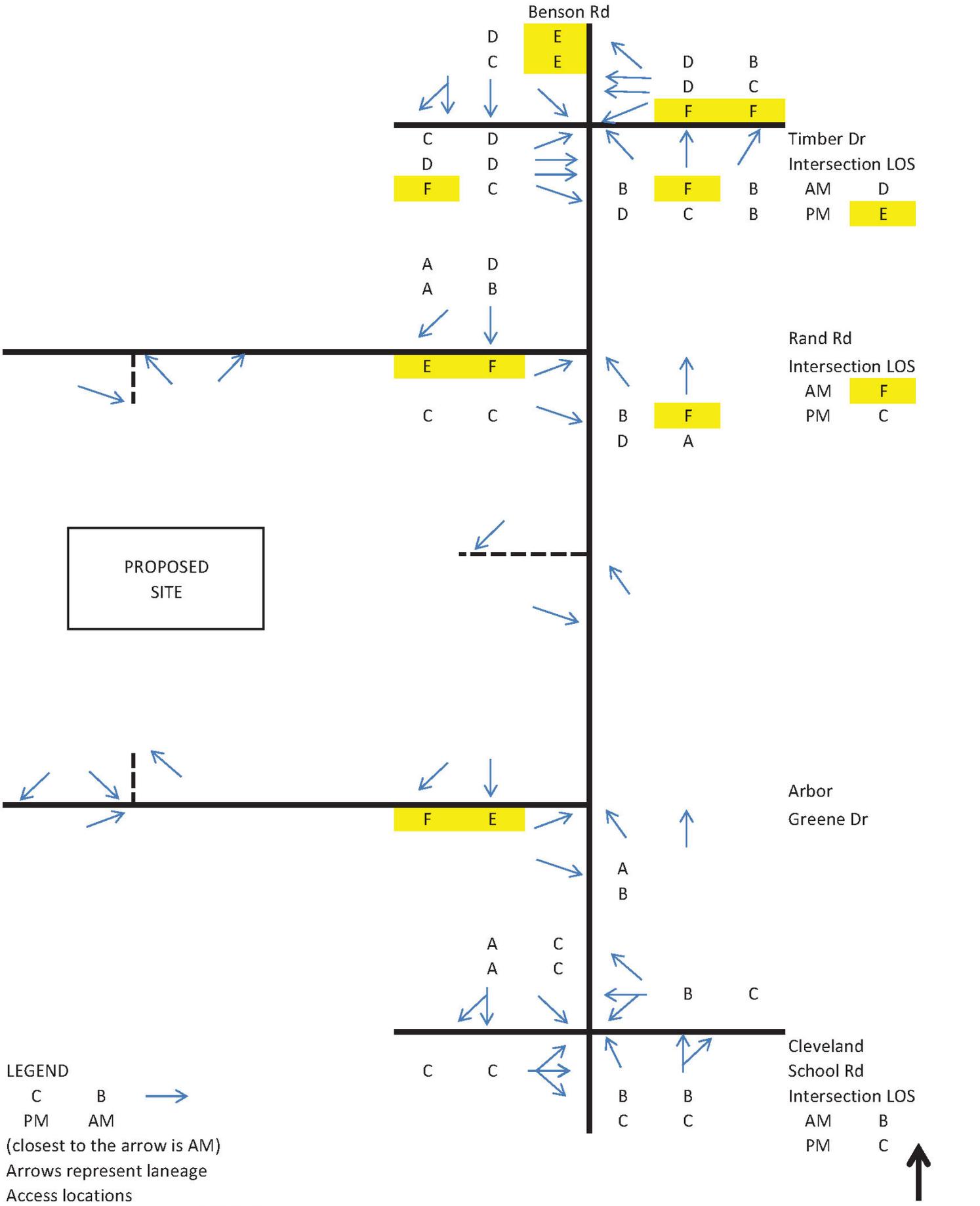
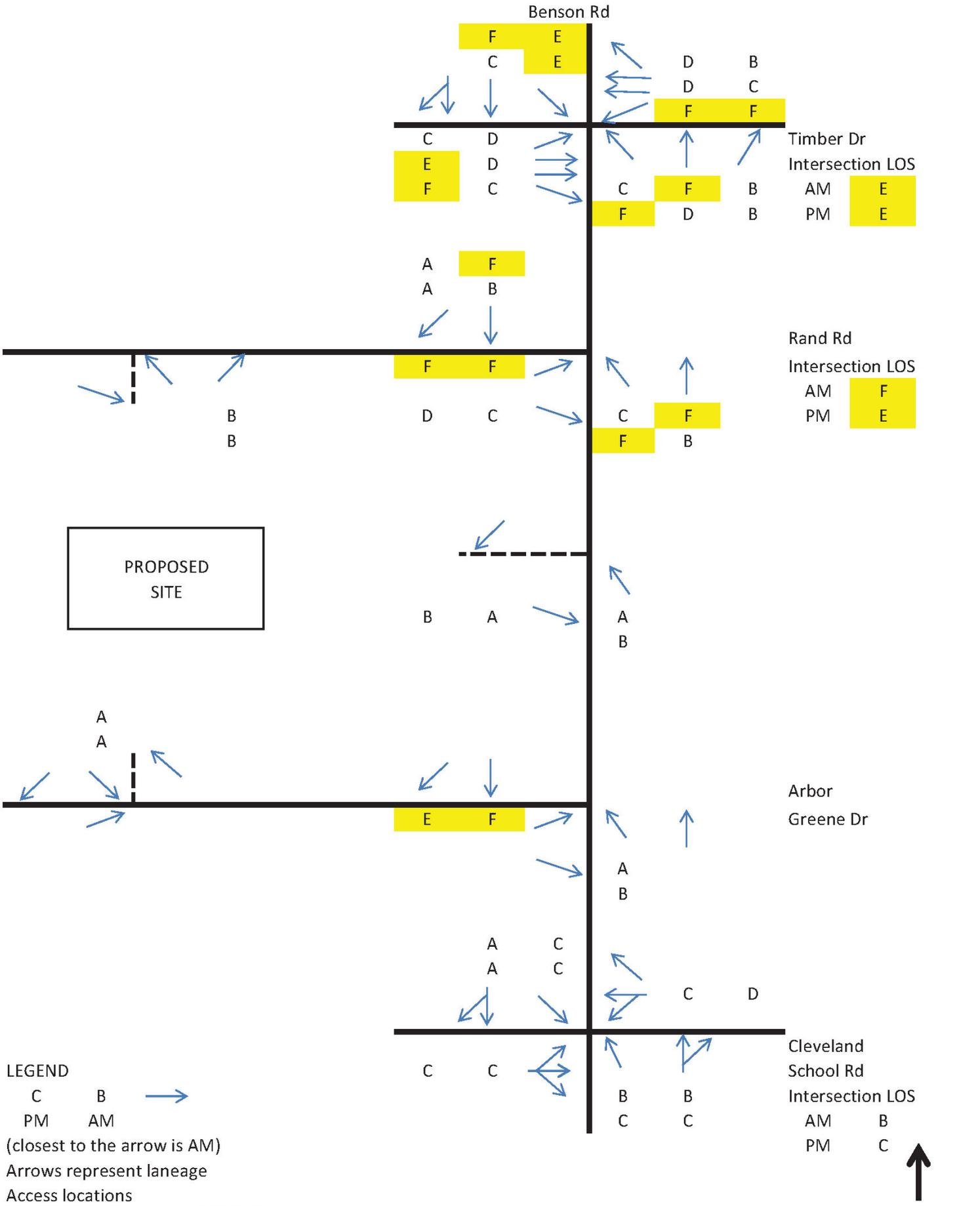


FIGURE 8  
 BUILD  
 LOS SUMMARY



LEGEND  
 C B →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage  
 Access locations

FIGURE 9  
 BUILD MITIGATED  
 LOS SUMMARY

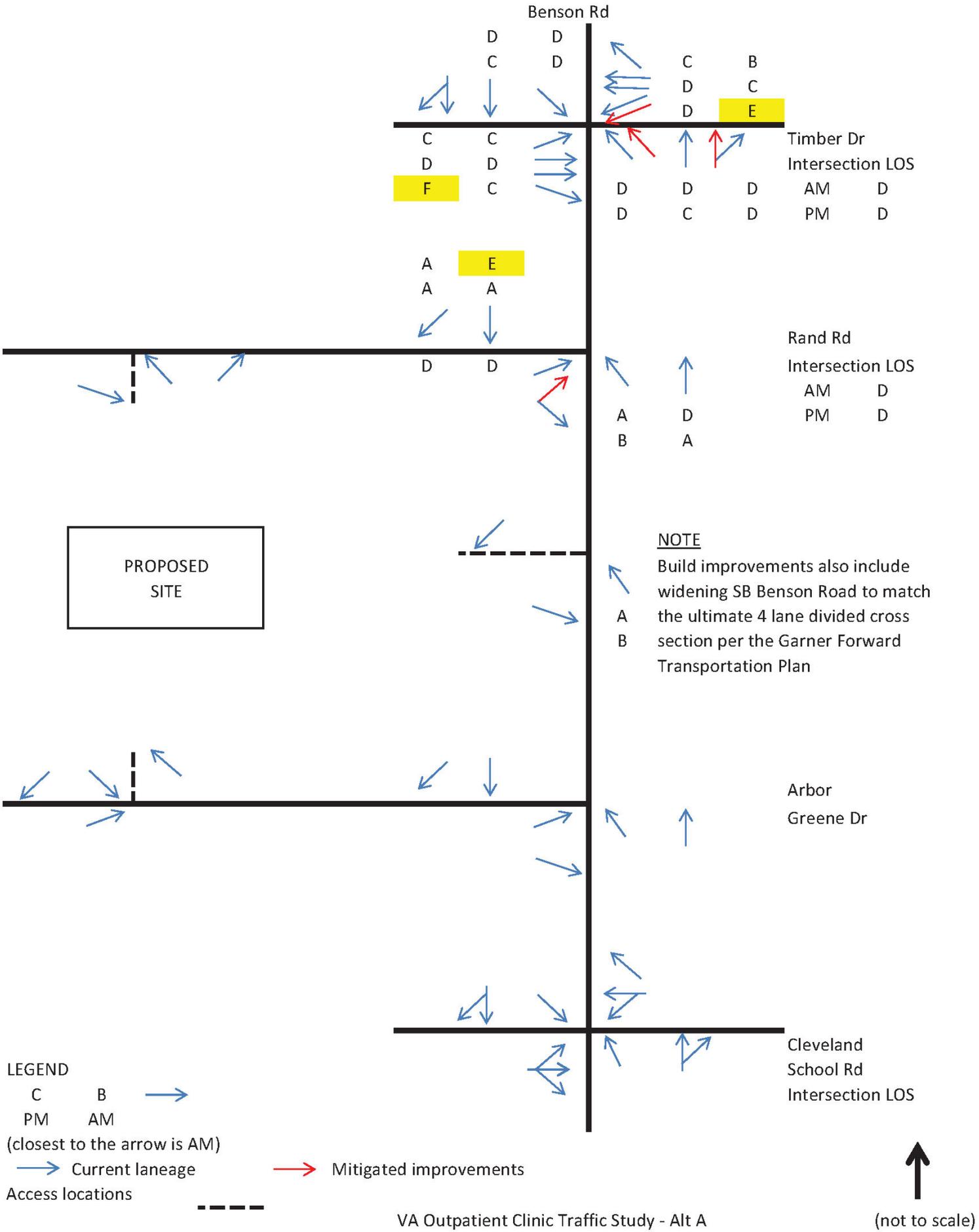


TABLE 3 - ALTERNATIVE A DELAY, LOS AND QUEUE SUMMARY

Storage Length (ft)	EXISTING AM			EXISTING PM			NO BUILD AM			NO BUILD PM			BUILD AM			BUILD PM			
	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	
<b>BENSON ROAD AND TIMBER DRIVE - SIGNALIZED</b>																			
EBL	255	38.9	D	158#	21.4	C	111	48.1	D	194#	27.3	C	121	41.6	D	164	31.6	C	117
EBT		43.5	D		31.9	C		50.7	D		48.3	D		52.4	D		64.4	E	
EBR		29.9	C		40.1	D		33.3	C		122.2	F		33.5	C		158.4	F	
WBL	245	36.2	D	166	107.7	F	430#	120.7	F	350#	186.0	F	588#	195.2	F	688#	115.5	F	662#
WBT		46.5	D		28.1	C		54.3	D		30.6	C		46.6	D		28.8	C	
WBR	245	37.2	D	57	18.3	B	12	41.9	D	63	19.0	B	20	37.2	D	59	17.7	B	257
NBL	120	13.3	B	190	25.0	C	142	15.8	B	237	46.9	D	286#	20.4	C	274	101.1	F	363#
NBT		39.6	D		27.5	C		73.5	F		34.1	C		126.2	F		43.0	D	
NBR	225	11.8	B	74	18.9	B	77	12.1	B	100	17.9	B	107	11.3	B	113	19.4	B	225
SBL	320	56.3	E	54	47.1	D	122	64.4	E	62	58.3	E	157#	62.5	E	61	65.9	E	175#
SBT-R		20.3	C		37.5	D		24.2	C		52.3	D		30.5	C		92.0	F	
Intersection		33.3	C		39.0	D		50.4	D		66.4	E		73.7	E		77.9	E	
<b>BENSON ROAD AND RAND ROAD - SIGNALIZED</b>																			
EBL	60	81.0	F	541#	49.3	D	275#	122.6	F	888#	70.8	E	374#	145.0	F	1077#	144.9	F	920#
EBR		22.2	C		22.3	C		33.1	C		28.5	C		32.8	C		38.7	D	
NBL	205	10.3	B	3	25.8	C	12	14.9	B	4	46.4	D	19	26.7	C	5	80.7	F	52#
NBT		45.7	F		5.7	A		86.8	F		6.8	A		105.9	F		13.4	B	
SBT		8.9	A		18.8	B		12.6	B		38.4	D		18.7	B		94.9	F	
SBR	215	0.6	A	0	1.1	A	0	0.4	A	0	0.9	A	0	0.4	A	0	0.6	A	0
Intersection		47.4	D		17.4	B		80.7	F		29.9	C		90.8	F		75.2	E	
<b>BENSON ROAD AND ARBOR GREENE DRIVE - UNSIGNALIZED</b>																			
EBL		31.3	D	30	35.5	E	15	48.2	E	51	52.3	F	25	52.3	F	65	42.3	E	29
NBL	220	7.8	A	0	10.8	B	2	7.9	A	0	11.8	B	2	7.9	A	0	12.1	B	3
<b>BENSON ROAD AND CLEVELAND SCHOOL ROAD - SIGNALIZED</b>																			
EBL-T-R		18.6	B		21.7	C		20.9	C		29.6	C		21.4	C		34.4	C	
WBL-T		17.9	B		22.2	C		20.0	B		30.3	C		20.4	C		35.1	D	
NBL	65	9.8	A	3	12.7	B	6	10.5	B	3	20.9	C	8	10.5	B	3	23.8	C	9
NBT		14.2	B		15.4	B		18.7	B		31.5	C		19.8	B		34.5	C	
SBL	115	6.9	A	60	9.4	A	251#	24.2	C	199#	30.0	C	529#	27.7	C	221#	30.9	C	653#
SBT-R		3.2	A		3.6	A		3.2	A		3.3	A		3.1	A		3.0	A	
Intersection		11.0	B		8.8	A		17.9	B		20.6	C		19.4	B		21.8	C	

Storage Length (ft)	EXISTING AM			EXISTING PM			NO BUILD AM			NO BUILD PM			BUILD AM			BUILD PM		
	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)
RAND ROAD ACCESS - UNSIGNALIZED																		
NBR	-	-	-	-	-	-	-	-	-	-	-	-	14.1	B		13.2	B	
BENSON ROAD ACCESS - UNSIGNALIZED																		
EBR	-	-	-	-	-	-	-	-	-	-	-	-	9.2	A		14.5	B	
NBL	200	-	-	-	-	-	-	-	-	-	-	-	9.1	A	8	12.8	B	6
ARBOR GREENE ACCESS - UNSIGNALIZED																		
SBL	-	-	-	-	-	-	-	-	-	-	-	-	9.6	A		9.3	A	

NOTE

In 95% Queue column, # denotes that volume exceeds capacity

TABLE 4 - ALTERNATIVE A DELAY, LOS AND QUEUE MITIGATION SUMMARY

Storage Length (ft)	BUILD AM			BUILD PM			MITIGATED BUILD AM			MITIGATED BUILD PM		
	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)
BENSON ROAD AND TIMBER DRIVE - SIGNALIZED												
EBL 255	41.6	D	164	31.6	C	117	32.4	C	143	25.1	C	120
EBS	52.4	D		64.4	E		41.3	D		42.5	D	
EBR	33.5	C		158.4	F		27.3	C		108.1*	F	
WBL 245	195.2	F	688#	115.5	F	662#	53.1	D	252#	62.0	E	274#
WBT	46.6	D		28.8	C		40.5	D		30.9	C	
WBR 245	37.2	D	59	17.7	B	257	31.7	C	43	19.2	B	19
NBL 120	20.4	C	274	101.1	F	363#	49.0	D	210	50.5	D	141
NBT	126.2	F		43.0	D		48.1	D		34.0	C	
NBR 225	11.3	B	113	19.4	B	225	53.7	D	-	49.2	D	-
SBL 320	62.5	E	61	65.9	E	175#	51.7	D	54	54.4	D	143#
SBT-R	30.5	C		92.0	F		26.2	C		51.5	D	
Intersection	73.7	E		77.9	E		44.1	D		53.5	D	
BENSON ROAD AND RAND ROAD - SIGNALIZED												
EBL 60	145.0	F	1077#	144.9	F	920#	48.8	D	305#	51.2	D	268#
EBS	32.8	C		38.7	D		-	-		-	-	
NBL 205	26.7	C	5	80.7	F	52#	5.5	A	3	13.6	B	18
NBT	105.9	F		13.4	B		52.7	D		7.3	A	
SBT	18.7	B		94.9	F		9.5	A		58.7	E	
SBR 215	0.4	A	0	0.6	A	0	0.1	A	0	0.5	A	0
Intersection	90.8	F		75.2	E		39.3	D		38.7	D	

NOTE

In 95% Queue column, # denotes that volume exceeds capacity

\*HCM methodology tends to overestimate delay for right turn movements near capacity. The Synchro reported delay for this movement is 45.5 sec / LOS D.

## **5.0 SUMMARY OF IMPACTS AND MITIGATION**

The resulting mitigation and improvements are summarized in four sections below. The first section summarizes the improvements necessary at the study intersections for the build scenario to not have negative traffic impacts compared to the no build scenario. The second section summarizes the improvements related to the proposed access locations. The third section summarizes additional mitigation strategies that will improve existing / no build traffic operations issues. The fourth section identifies improvements that will be provided to facilitate the future Benson Road corridor per the Garner Forward Transportation Plan.

### *Study Intersection Improvements to Mitigate Traffic Impacts of Build Scenario Compared to No Build Scenario*

- Benson Road and Rand Road Intersection  
Provide a second eastbound left turn lane (shared with the right turn movement).

### *Improvements Related to Access Locations*

- Benson Road Access  
Construct an exclusive right turn lane (200' storage) and exclusive left turn lane (200' storage) for ingress.
- Arbor Greene Drive Access  
Construct an exclusive right turn lane (200' storage) for ingress.

### *Additional Mitigation Strategies to Improve Existing / No Build Traffic Operations Issues*

- Benson Road and Timber Drive  
Provide a second northbound left turn lane, a second westbound left turn lane and a second northbound thru lane (shared with the right turn movement).
- Benson Road and Cleveland School Road  
Modify the southbound left turn phasing to protected only.

### *Improvements to Facilitate the Future Benson Road Corridor per the Garner Forward Transportation Plan*

- Widen southbound (proposed site side only) Benson Road to match the ultimate four lane divided cross section (this widening includes an additional through lane and half of the median).

## E.2 Traffic Impact Study for Alternative B

# U.S. Department of Veterans Affairs



## TRAFFIC IMPACT STUDY FOR THE RALEIGH OUTPATIENT CLINIC – ALTERNATIVE B WAKE COUNTY, NORTH CAROLINA

July 2020

**Contract Number:** GS-10F-0360T **Order Number:** 36C10F20F0039

**Prepared for:**

U.S. Department of Veterans Affairs  
Office of Construction and Facilities Management

**Prepared by:**

EPR  
902 E Jefferson St, Suite 101  
Charlottesville, VA 22902  
(434) 202-5082  
[www.epr-pc.com](http://www.epr-pc.com)

Under Subcontract to:

LRS Federal LLC  
565 Benfield Blvd, Suite 400  
Severna Park, MD 21146  
(443) 760-4460  
[www.lrsfederal.com](http://www.lrsfederal.com)

## TABLE OF CONTENTS

1.0	Project Overview
2.0	Project Area
3.0	Future Year Traffic Volumes
4.0	Intersection Capacity Analyses
5.0	Summary of Impacts and Mitigation

## LIST OF FIGURES

Figure 1A-C	Vicinity Maps
Figure 1D	Site Access Concept
Figure 2A	Existing 2018 Peak Hour Volumes
Figure 2B	Existing 2020 Factored Peak Hour Volumes
Figure 3A	No Build 2024 Pre Route 540 Scenario Peak Hour Volumes
Figure 3B	No Build 2024 Post Route 540 Scenario Peak Hour Volumes
Figure 4A	Site Trips Pre Route 540 Scenario
Figure 4B	Site Trips Post Route 540 Scenario
Figure 5A	Build 2024 Pre Route 540 Scenario Peak Hour Volumes
Figure 5B	Build 2024 Post Route 540 Scenario Peak Hour Volumes
Figure 6	Existing LOS
Figure 7	No Build Pre Route 540 Scenario LOS
Figure 8	Build Pre Route 540 Scenario LOS
Figure 9	Build Mitigated Pre Route 540 Scenario LOS
Figure 10	No Build Post Route 540 Scenario LOS
Figure 11	Build Post Route 540 Scenario LOS
Figure 12	Build Mitigated Post Route 540 Scenario LOS

## LIST OF TABLES

Table 1	Proposed Site Trip Generation
Table 2	LOS & Delay Thresholds
Table 3	Pre Route 540 Delay, LOS and Queue Summary (Existing, No Build and Build Comparison)
Table 4	Pre Route 540 Delay, LOS and Queue Summary (Build and Build Mitigated Comparison)
Table 5	Post Route 540 Delay, LOS and Queue Summary (Existing, No Build and Build Comparison)
Table 6	Post Route 540 Delay, LOS and Queue Summary (Build and Build Mitigated Comparison)

## TECHNICAL APPENDICES

- Appendix A Memorandum of Understanding
- Appendix B Traffic Data Methodology Memorandum
- Appendix C Count Data Provided from Route 540 Project Website
- Appendix C2 Calculations to Utilize Route 540 Volume Data
- Appendix D Count Data (Collected in May 2020)
- Appendix E Trip Generation and Distribution Methodology Memorandum
- Appendix F Intersection Capacity Analysis Synchro Worksheets – Existing
- Appendix G Intersection Capacity Analysis Synchro Worksheets – Pre Route 540 No Build
- Appendix H Intersection Capacity Analysis Synchro Worksheets – Pre Route 540 Build
- Appendix I Intersection Capacity Analysis Synchro Worksheets – Pre Route 540 Build Mitigated
- Appendix J Intersection Capacity Analysis Synchro Worksheets – Post Route 540 No Build
- Appendix K Intersection Capacity Analysis Synchro Worksheets – Post Route 540 Build
- Appendix L Intersection Capacity Analysis Synchro Worksheets – Post Route 540 Build Mitigated
- Appendix M Ten Ten Road and Rand Road Peak Hour Signal Warrant Graph

## **1.0 PROJECT OVERVIEW**

### **Purpose**

The United States Department of Veterans Affairs (VA) is proposing to construct an outpatient facility in Wake County, North Carolina. The project consists of two build alternatives and one no-build alternative currently under consideration. Alternative B is located southeast of the intersection of Ten Ten Road and Old Stage Road, and is the subject of this traffic study. Alternative A is evaluated in a separate traffic study. The following Traffic Impact Study has been prepared to assist in the preparation of an Environmental Assessment (EA) document for the purposes of the National Environmental Policy Act (NEPA). This study will identify any traffic impacts of the proposed development compared to the no build scenario and if any exist, identify potential improvement measures to mitigate the impacts.

### **Proposed Site**

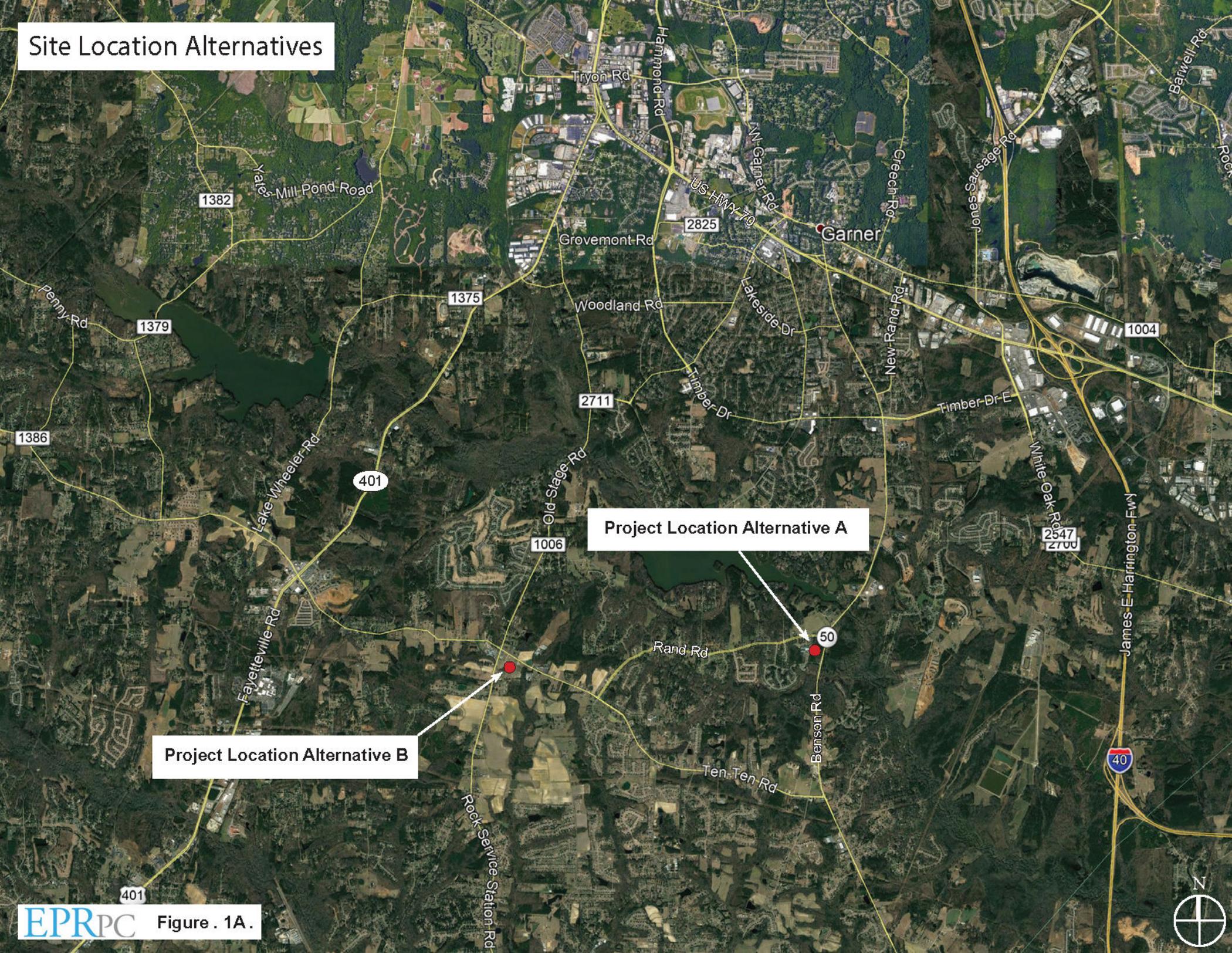
The proposed site is located in the southeastern quadrant of the Old Stage Road and Ten Ten Road intersection. Figures 1A-C illustrate the vicinity of the proposed site. Figure 1D illustrates a conceptual layout of the site access points. Site plans are not available, but Figure 1D represents the access scenario evaluated in this study. While this might not represent the final conceptual design, the purpose of this study is to determine if there is a development scenario that may be built without negatively impacting traffic operations compared to the no build scenario.

The planned VA Outpatient Clinic is proposed to have over 222,325 square feet of space with 1,300 parking spaces. The clinic is expected to have 350-400 employees and serve approximately 500 patients per day. The Alternative B site is approximately 32.88 acres based on GIS data.

### **Consultation**

There were various meetings and consultations with NCDOT and Town of Garner staff to identify the various technical methodologies and assumptions. These consultations included a scoping meeting to identify the scope of work and primary methodologies, as well as additional, specific consultations regarding traffic data, trip generation, and trip distribution. These consultations are referenced in the appropriate sections of this document and the resulting memoranda are provided in the technical appendices as referenced in the document.

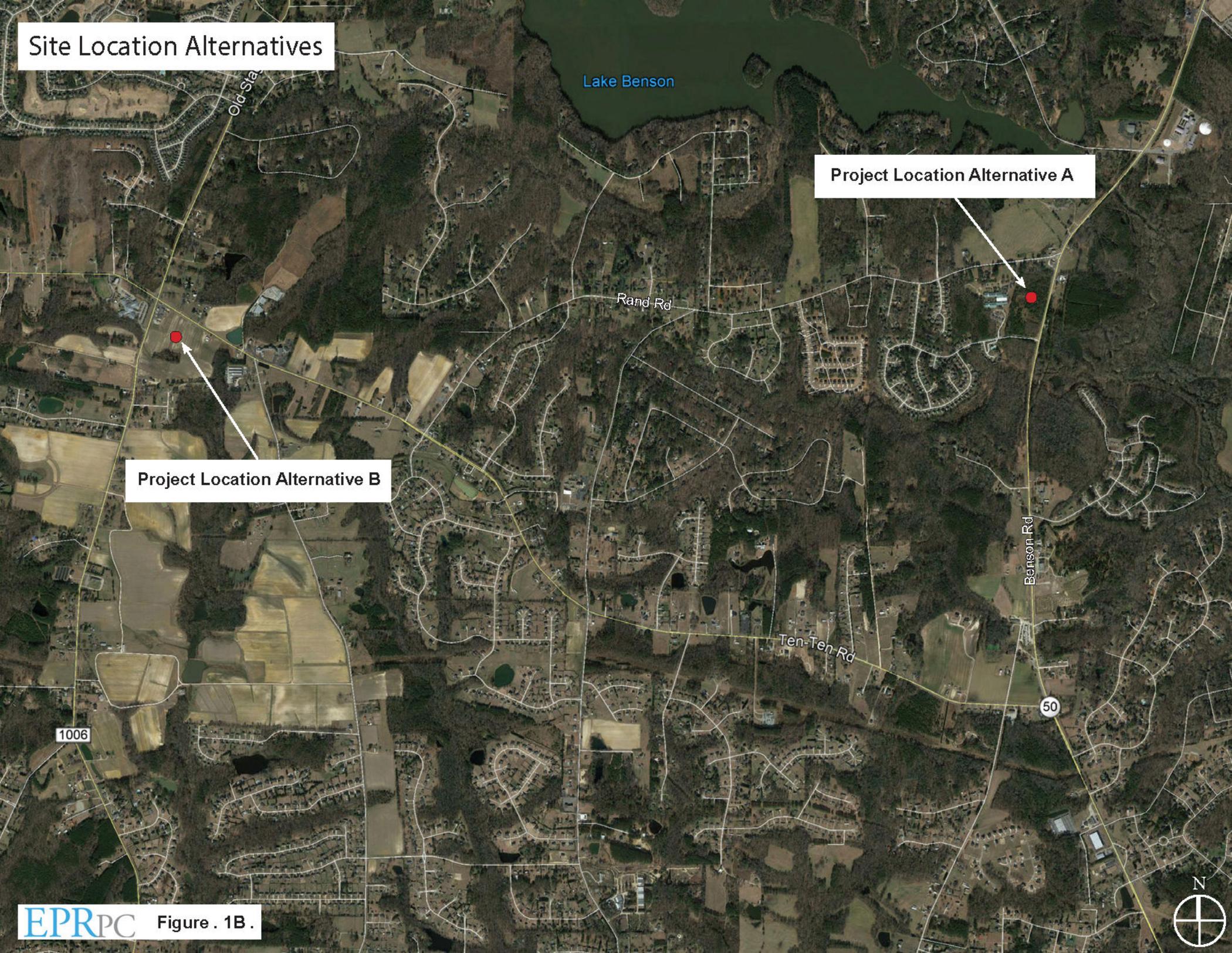
# Site Location Alternatives



Project Location Alternative A

Project Location Alternative B

# Site Location Alternatives



Project Location Alternative A

Project Location Alternative B

Lake Benson

Rand Rd

Ten-Ten Rd

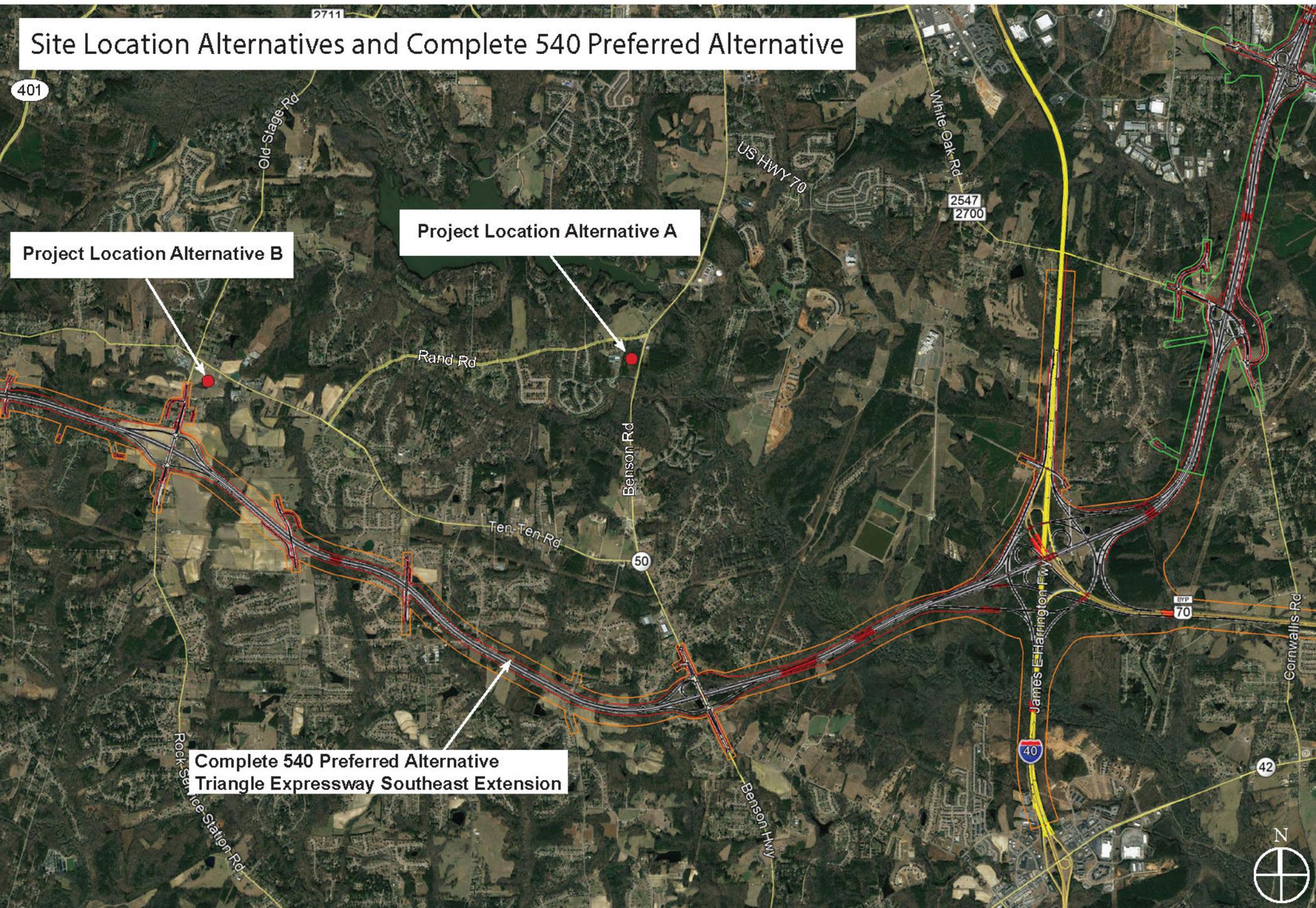
Benson Rd

1006

50



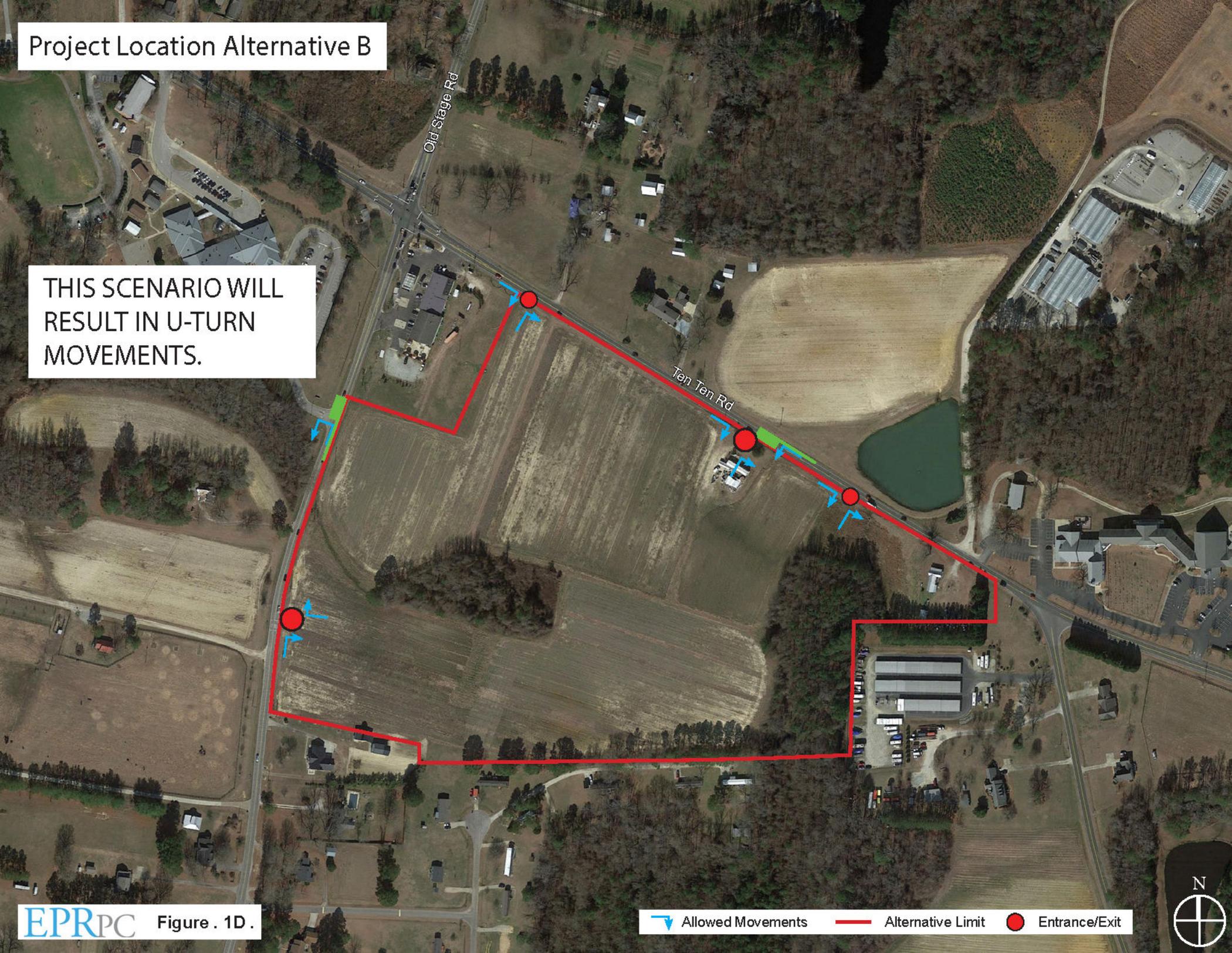
# Site Location Alternatives and Complete 540 Preferred Alternative



EPRPC Figure . 1C .

# Project Location Alternative B

THIS SCENARIO WILL RESULT IN U-TURN MOVEMENTS.



## **2.0 PROJECT AREA**

The Memorandum of Understanding that resulted from a traffic study scoping meeting with representatives from North Carolina Department of Transportation (NCDOT) and the Town of Garner is provided in Appendix A.

The future Route 540 Corridor is proposed to interchange with Old Stage Road just south of this proposed outpatient clinic location. As such, during the scoping meeting, two sets of study areas were recognized, related to a Pre Route 540 scenario and a Post Route 540 scenario. The following traffic study locations were identified as the study area for the two scenarios.

### Pre Route 540 Scenario

- Old Stage Road and Ten Ten Road - signalized
- Ten Ten Road and Rand Road – unsignalized
- Site access locations – unsignalized

### Post Route 540 Scenario

- Old Stage Road and Ten Ten Road - signalized
- Old Stage Road and Route 540 Interchange (two ramp intersections) - signalized
- Site access locations – unsignalized

Old Stage Road is generally a two lane undivided facility that is one of only two north-south corridors between Route 401 and I-40. In the project area, the facility primary serves residential neighborhoods and the posted speed limit is 45 miles per hour (mph).

Ten Ten Road is generally a two lane divided facility that is a primary east-west connection between Route 401 and Benson Road. In the project area, the facility primary serves residential neighborhoods and the posted speed limit is 45 mph.

Route 540 is a planned, four lane limited access facility that will serve as a regional highway in the general area.

The existing geometry at the study intersections is illustrated in the existing volume figures (Figures 2A and 2B).

### **Existing Traffic Volumes**

With the pandemic impact to typical traffic volumes, obtaining traffic volume data for the study required a detailed process. The methodology was documented in a separate memorandum provided in Appendix B. Count data from the Route 540 project website is provided in Appendix C. The calculations and process to utilize the Route 540 volume data in this study is provided in Appendix C2. Count data that was field collected specifically for this study is provided in Appendix D.

Figure 2A illustrates the existing peak hour count data as factored to the year 2018. Figure 2B illustrates the year 2020 existing volumes utilized for the study. See the memorandum in Appendix B for a detailed description of this methodology.

FIGURE 2A  
 YEAR 2018  
 PEAK HOUR VOLUMES



PROPOSED  
 SITE

LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage

↑  
 NORTH  
 (not to scale)

FIGURE 2B  
 EXISTING - FACTORED TO YEAR 2020  
 PEAK HOUR VOLUMES



PROPOSED  
 SITE

**NOTE**  
 These movements counted as 0 vph, but increased to 5 vph

LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage

↑  
 NORTH  
 (not to scale)

### 3.0 FUTURE YEAR TRAFFIC VOLUMES

#### Background Traffic

It is assumed that the clinic will be operational by 2024. A standard three percent growth rate was utilized to determine the background traffic volume. The resulting 2024 no build traffic volumes are illustrated in Figure 3A (Pre Route 540 Scenario) and Figure 3B (Post Route 540 Scenario).

#### Proposed Site Trip Generation

The VA does not have specific trip generation data for their outpatient clinics. As the *ITE Trip Generation Manual* does not provide ideally compatible data, an alternative methodology was documented in a separate memorandum provided in Appendix E. The summary is that the ITE code clinic based on employees is utilized with the exception of PM peak out. For the PM peak out value, the ITE generated clinic volume (218) was increased to 276 so that the PM peak out volume is 80 percent of the AM peak in volume. This ratio matches the clinic use based on square feet and provides a more conservative volume. The trip generation is summarized in Table 1.

**TABLE 1**  
**Site Generated Traffic**  
**(Vehicles Per Hour)**

USE	ITE CODE	ADT	AM PEAK		PM PEAK	
			IN	OUT	IN	OUT
Clinic (based on employees - 400)	630	3700	345	103	122	276*

Source: ITE Trip Generation Manual 10<sup>th</sup> Edition (\*except PM Peak Out)

ADT – Annual Daily Traffic, other volumes are vehicles per hour

#### Traffic Distribution

The general traffic distribution was also discussed during the traffic study scoping meeting. The final distribution was referenced in the memorandum provided in Appendix E. The site trips, distribution percentages, and resulting site trips are illustrated in Figure 4A (Pre Route 540 Scenario) and Figure 4B (Post Route 540 Scenario).

#### Build Year 2024 Traffic Volumes

The no build volumes and site trip volumes combine to generate the total build (year 2024) volumes. These volumes are illustrated in Figure 5A (Pre Route 540 Scenario) and Figure 5B (Post Route 540 Scenario).

FIGURE 3A  
 NO BUILD 2024 - PRE ROUTE 540 SCENARIO  
 PEAK HOUR VOLUMES

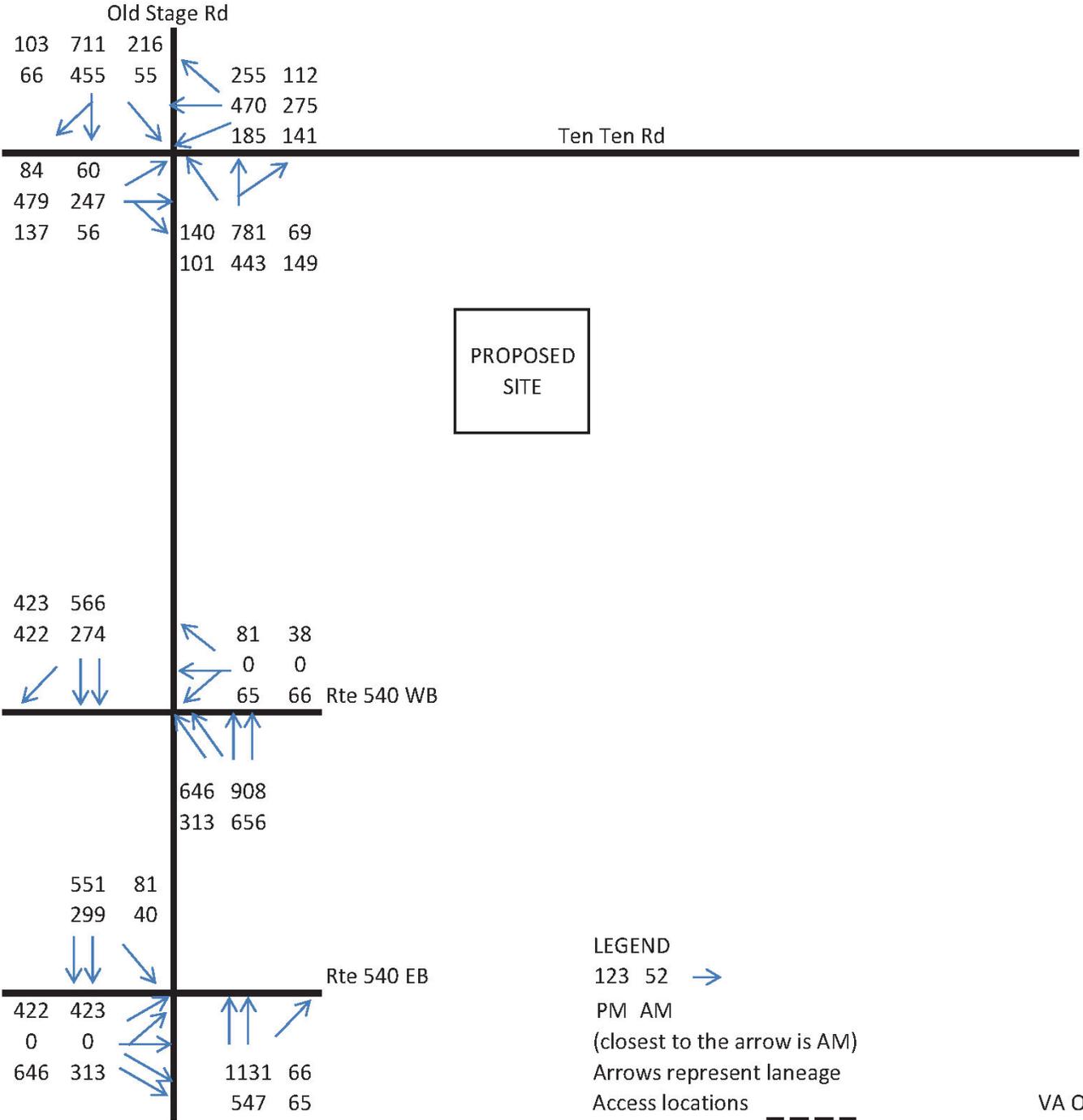


PROPOSED  
SITE

LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage

↑  
 NORTH  
 (not to scale)

FIGURE 3B  
 NO BUILD 2024 - POST ROUTE 540 SCENARIO  
 PEAK HOUR VOLUMES

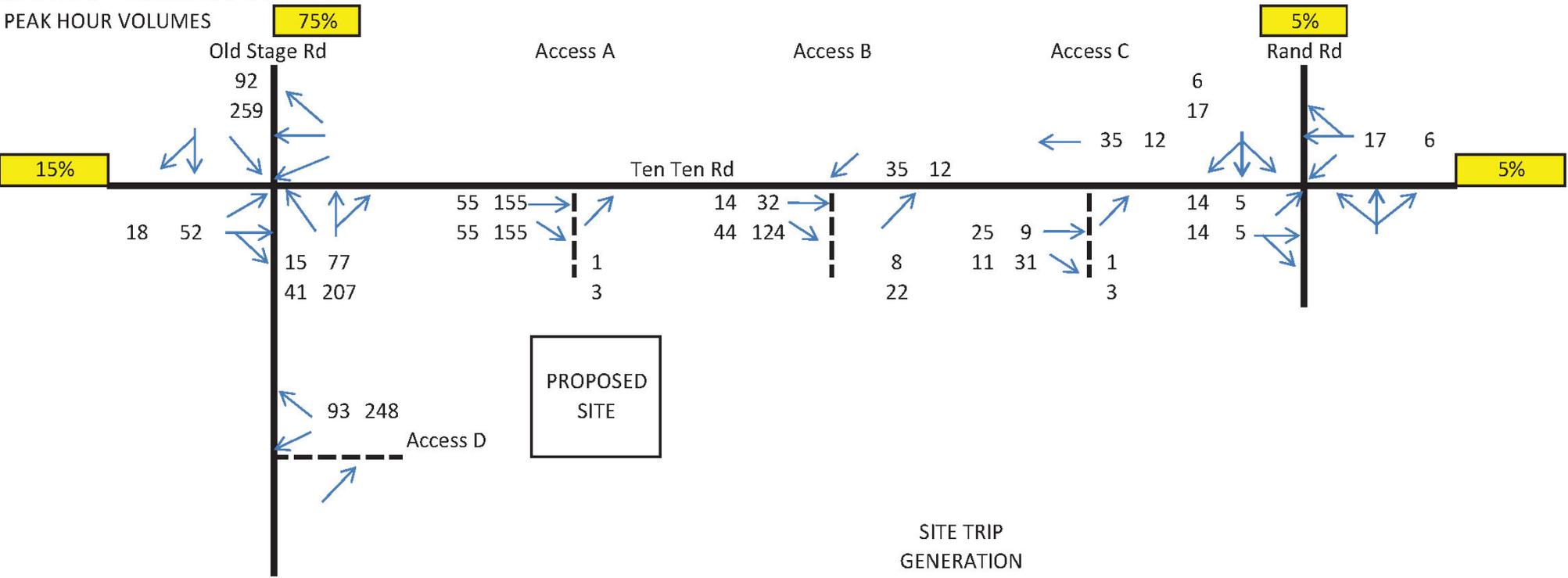


PROPOSED  
SITE

LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage  
 Access locations -----

↑  
 NORTH  
 (not to scale)

FIGURE 4A  
 SITE TRIPS - PRE ROUTE 540 SCENARIO  
 PEAK HOUR VOLUMES



PROPOSED  
 SITE

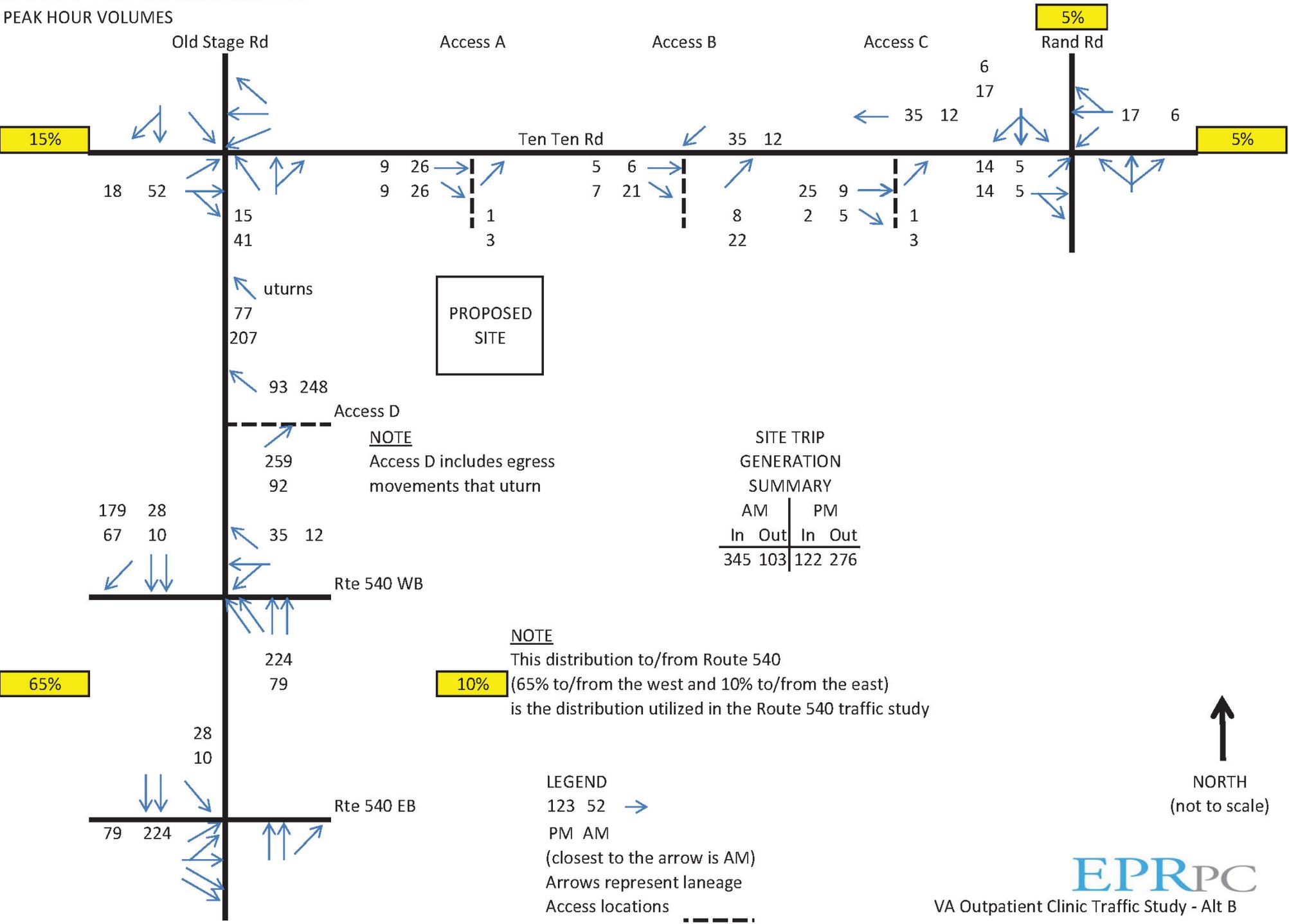
SITE TRIP  
 GENERATION  
 SUMMARY

AM		PM	
In	Out	In	Out
345	103	122	276

LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage  
 Access locations - - - - -

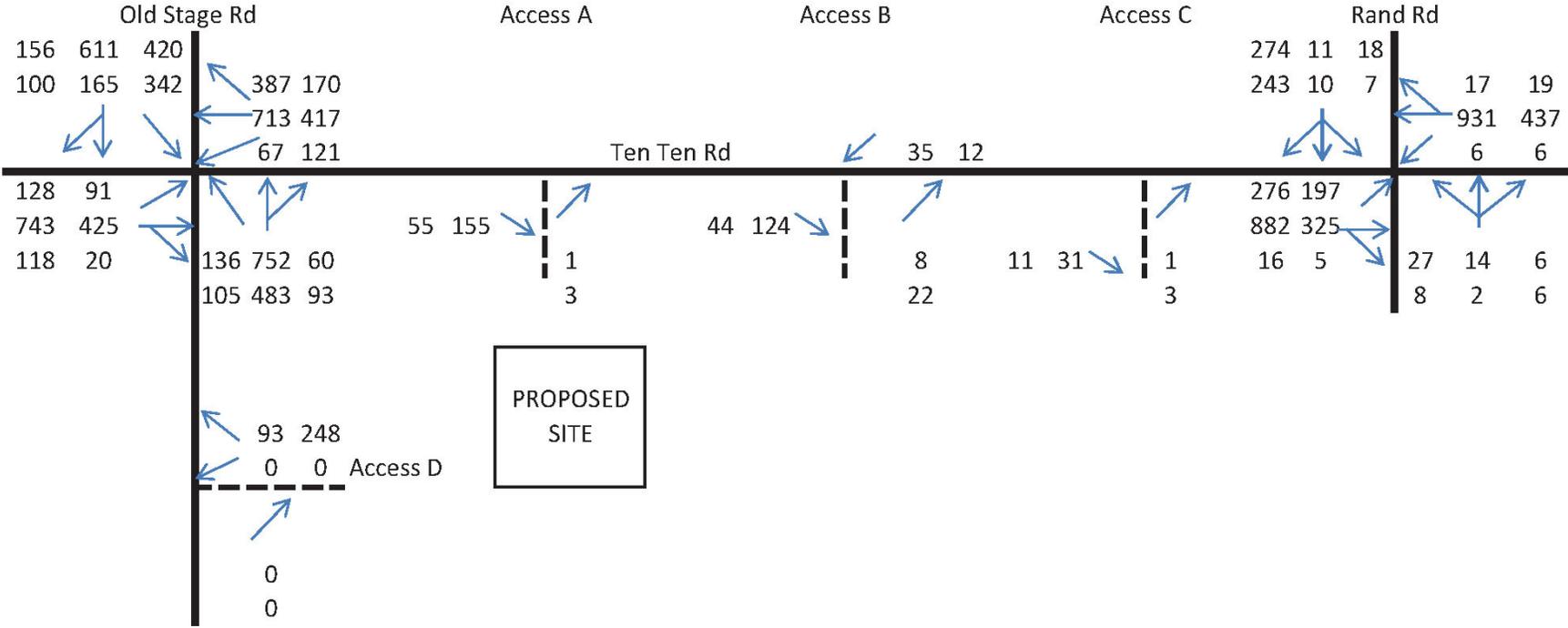
↑  
 NORTH  
 (not to scale)

FIGURE 4B  
 SITE TRIPS - POST ROUTE 540 SCENARIO  
 PEAK HOUR VOLUMES

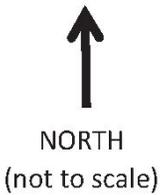


↑  
 NORTH  
 (not to scale)

FIGURE 5A  
 BUILD 2024 - PRE ROUTE 540 SCENARIO  
 PEAK HOUR VOLUMES



LEGEND  
 123 52 →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage  
 Access locations - - - - -





## 4.0 INTERSECTION CAPACITY ANALYSES

### Methodology

The intersection capacity analyses were performed using Synchro (version 9) per the methodology documented in the Highway Capacity Manual (HCM) (Transportation Research Board). The HCM based calculations are provided in this report, except when HCM limitations do not provide for a calculation, and Synchro values are provided. SimTraffic calculations were utilized to evaluate the u-turn location on Old Stage Road.

Typically, actual peak hour factor (PHF) and truck percentage (HV%) data calculated from the manual turning movement count (TMC) is utilized for capacity analysis. However, as a result of the alternative methods required to obtain and derive existing traffic count data (described in Appendix B), NCDOT standard defaults were utilized. Similarly, signal plan information for the signalized intersections was not provided, so NCDOT standard defaults were utilized.

Capacity analyses are utilized to determine a Level of Service (LOS) for a given intersection operating under either signalized or unsignalized control. The LOS is based on estimated delay and range from LOS A, the best, to LOS F, the worst. In general LOS A and LOS B indicate little or no delay, LOS C indicates average delay, LOS D indicates delay is increasing and noticeable, LOS E indicates the limit of acceptable delay and F is characteristic of over saturated conditions. The actual delays associated with these levels of service are identified in Table 2.

**TABLE 2**  
**LOS and Delay Thresholds**

<b>LOS</b>	<b>UNSIGNALIZED INT. DELAY (secs)</b>	<b>SIGNALIZED INT. DELAY (secs)</b>
A	0 – 10	< 10
B	> 10 – 15	> 10 – 20
C	> 15 – 25	> 20 – 35
D	> 25 – 35	> 35 – 55
E	> 35 – 50	> 55 – 80
F	> 50	> 80

Source: Highway Capacity Manual

The analysis results (delay, LOS and 95<sup>th</sup> percentile queue) for the Pre Route 540 scenario are summarized in Table 3 (comparing existing, no build and build) and Table 4 (comparing build to build mitigated) and for the Post Route 540 scenario are summarized in Table 5 (comparing existing, no build and build) and Table 6 (comparing build to build mitigated).

The results are also illustrated as follows:

-Figure 6 – Existing

-Figures 7-9 – Pre Route 540 (existing, no build, build and build mitigated respectively)

-Figures 10-12 – Post Route 540 (existing, no build, build and build mitigated respectively)

The HCM based intersection capacity analysis worksheets from Synchro are provided in the appendix. The existing scenario is located in Appendix F. The Pre Route 540 no build scenario is in Appendix G, the Pre Route 540 build is in Appendix H, and the Pre Route 540 mitigated build scenario is in Appendix I. The Post Route 540 no build is in Appendix J, the Post Route 540 build is in Appendix k, and the Post Route 540 mitigated build scenario is in Appendix L.

## **Study Intersections**

### *Old Stage Road and Ten Ten Road - Signalized*

There is a committed and funded improvement project at this intersection to add an exclusive westbound right turn lane. This improvement has been included for all no build and build scenarios.

### Pre Route 540 Scenario

For the Pre Route 540 scenario, the Old Stage Road and Ten Ten Road intersection analysis indicates operational issues in the existing and no build scenarios, with several movements operating at unsatisfactory levels of service (LOS E and LOS F). With the intersection already projected to operate unsatisfactorily in the no build condition, the build condition analysis projects minimal change. There are several individual movements similarly projected to operate at LOS E / LOS F, with an overall intersection level of service of LOS F like the no build condition.

Although the operational issues are related to existing and background volume growth, mitigation testing was conducted to determine what improvements would effectively improve operations. Given the no build operational issues, substantial improvements are required to improve operations. The improvements tested are adding a second eastbound through lane (shared with the right turn movement), adding a second northbound through lane, adding a second westbound through lane, adding an overlap signal phase to the westbound right turn movement, changing the northbound left turn phasing to protected-permitted, adding a second southbound through lane (shared with the right turn movement), and adding a second southbound left turn lane. Combined, these improvements result in satisfactory operational improvements.

### Post Route 540 Scenario

For the Post Route 540 scenario, the analysis indicates the same basic results with operational issues in the existing and no build scenarios (several movements operating at unsatisfactory levels of service, LOS E and LOS F). Likewise, with the intersection already projected to operate unsatisfactorily in the no build condition, the build condition analysis projects minimal change. There are several individual movements similarly projected to operate at LOS E / LOS F, with an overall intersection level of service of LOS F like the no build condition.

Although the operational issues are related to existing and background volume growth, mitigation testing was conducted to determine what improvements would effectively improve operations. Given the no build operational issues, substantial improvements are required to improve operations, although with the Route 540 corridor impact, there are fewer improvements required. The improvements tested are adding an exclusive eastbound right turn lane, adding a second northbound through lane (shared with the right turn movement), adding a second westbound through lane, adding an overlap signal phase to the westbound right turn movement,

changing the northbound left turn phasing to protected-permitted, and adding a second southbound through lane (shared with the right turn movement). Combined, these improvements result in satisfactory operational improvements.

#### *Ten Ten Road and Rand Road (Pre Route 540 Scenario Only) - Unsignalized*

The Ten Ten Road and Rand Road intersection analysis indicates operational issues in the existing and no build scenarios, with the side street movements operating at LOS F. With the intersection already projected to operate unsatisfactorily in the no build condition, the build condition analysis projects minimal change with the same unsatisfactory levels of service projected.

Although the operational issues are related to existing and background volume growth, mitigation strategies were considered to improve operations. Even though the side street volume is very low at this intersection (with the exception of the southbound right turn movement), the Ten Ten Road traffic volume does not allow enough gaps for the side street movements to operate at a satisfactory level of service. Typical roundabout volume criteria are not met. An exclusive southbound right turn lane improves that one specific movement, but does not result in the other side street movements operating satisfactorily. This intersection does meet the Manual on Urban Traffic Control Devices (MUTCD) Signal Warrant 3 – Peak Hour Volume warrant utilizing no build traffic volumes (warrant graph provided in Appendix M). For this warrant evaluation, the eastbound left turn was utilized as the side street volume. Full signal warrants will need to be conducted in the future to better determine the appropriateness of signalization. With the addition of an exclusive southbound right turn lane and signalization, the intersection is expected to operate satisfactorily with all movements operating at LOS D or better.

#### *Old Stage Road and Route 540 Ramp Junction Intersections (Post Route 540 Scenario Only) - Signalized*

The Old Stage Road and Route 540 Ramp Junction (two separate ramp junctions) intersection analyses indicate both intersections operate satisfactorily in the no build and build scenarios, with all individual movements operating at LOS D or better.

### **Access Locations**

There are three proposed access locations on Ten Ten Road (labeled A – C, from west to east). Access locations A and C are right in / right out only, while location B also allows for left in. Note that egress from Ten Ten Road does not provide for motorists to travel westbound on Ten Ten Road. Testing of both direct left turn egress movements and right out then u-turn maneuvers indicate unsatisfactory levels of service. The Old Stage Road access is also right in / right out only, but testing indicates that u-turn maneuvers north of the access would operate satisfactorily.

#### *Ten Ten Road Access A*

The Ten Ten Road Access A location was modeled as right in only ingress and right out only egress allowed. The ingress includes an exclusive right turn lane (200' storage).

#### *Ten Ten Road Access B*

The Ten Ten Road Access B location access was modeled as right out only egress and full ingress allowed. The ingress includes exclusive right turn and left turn lanes (200' storage).

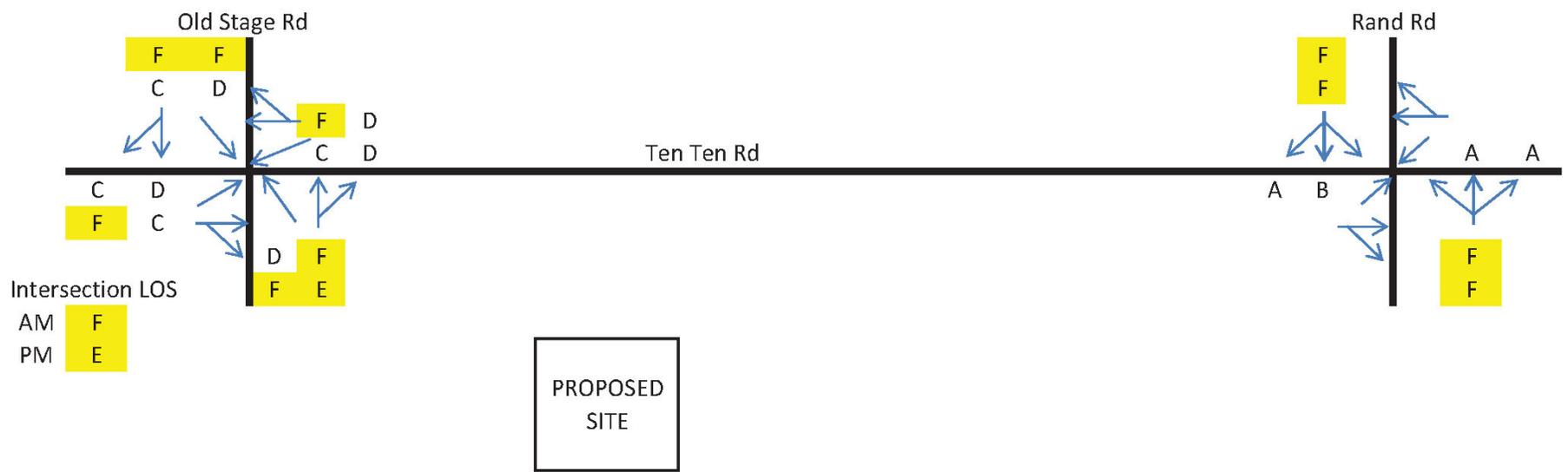
*Ten Ten Road Access C*

The Ten Ten Road Access C location was modeled as right in only ingress and right out only egress allowed. The ingress includes an exclusive right turn lane (200' storage).

*Old Stage Road Access D*

The Old Stage Road Access D location was modeled as right in only ingress and right out only egress allowed. The ingress includes an exclusive right turn lane (200' storage). This access was also modeled with a northbound to southbound u-turn maneuver between this access and Old Stage Road. This movement includes an exclusive left turn lane (200' storage).

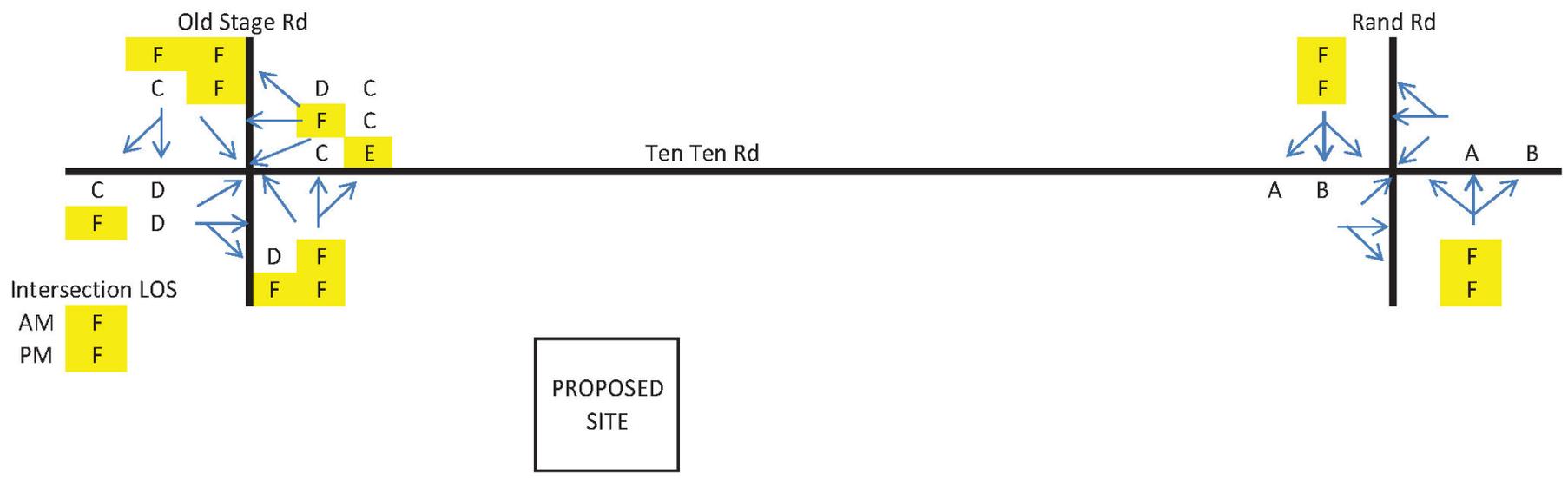
FIGURE 6  
EXISTING  
LOS



LEGEND  
C B →  
PM AM  
(closest to the arrow is AM)  
Arrows represent laneage

↑  
NORTH  
(not to scale)

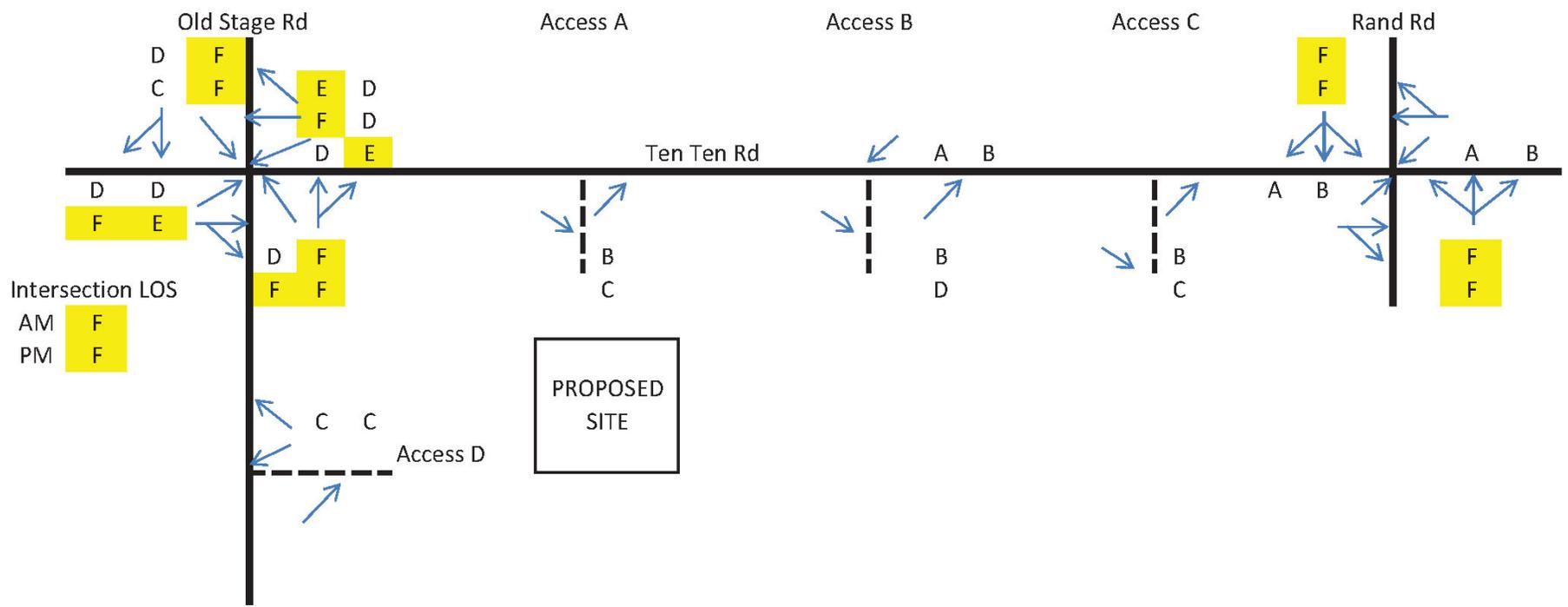
FIGURE 7  
 NO BUILD - PRE ROUTE 540 SCENARIO  
 LOS



LEGEND  
 C B →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage

↑  
 NORTH  
 (not to scale)

FIGURE 8  
 BUILD 2024 - PRE ROUTE 540 SCENARIO  
 LOS

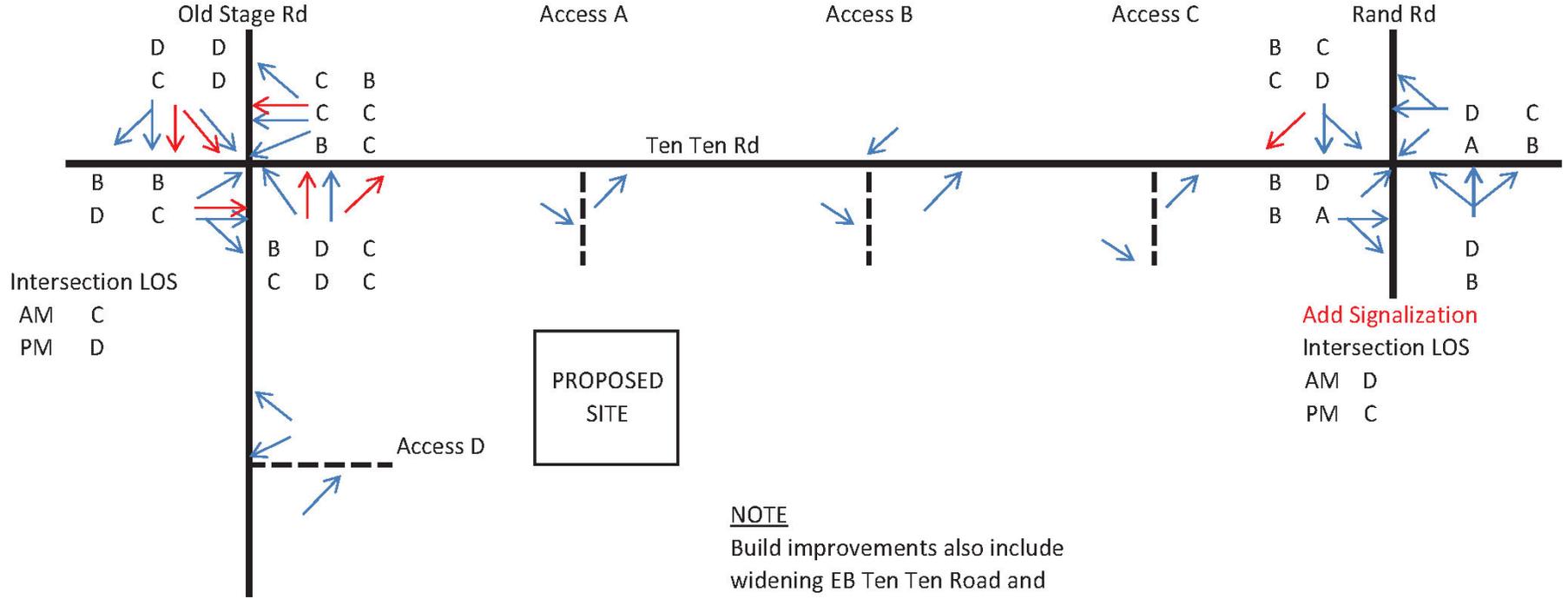


Intersection LOS  
 AM F  
 PM F

LEGEND  
 C B →  
 PM AM  
 (closest to the arrow is AM)  
 Arrows represent laneage  
 Access locations - - - - -

↑  
 NORTH  
 (not to scale)

FIGURE 9  
 BUILD 2024 MITIGATED - PRE ROUTE 540 SCENARIO  
 LOS



NOTE  
 Build improvements also include widening EB Ten Ten Road and NB Old Stage Road to match the ultimate 4 lane divided cross section per the Garner Forward Transportation Plan

**LEGEND**  
 C B →  
 PM AM  
 (closest to the arrow is AM)  
 → Current laneage  
 → Mitigated improvements  
 Access locations - - - - -

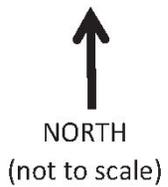
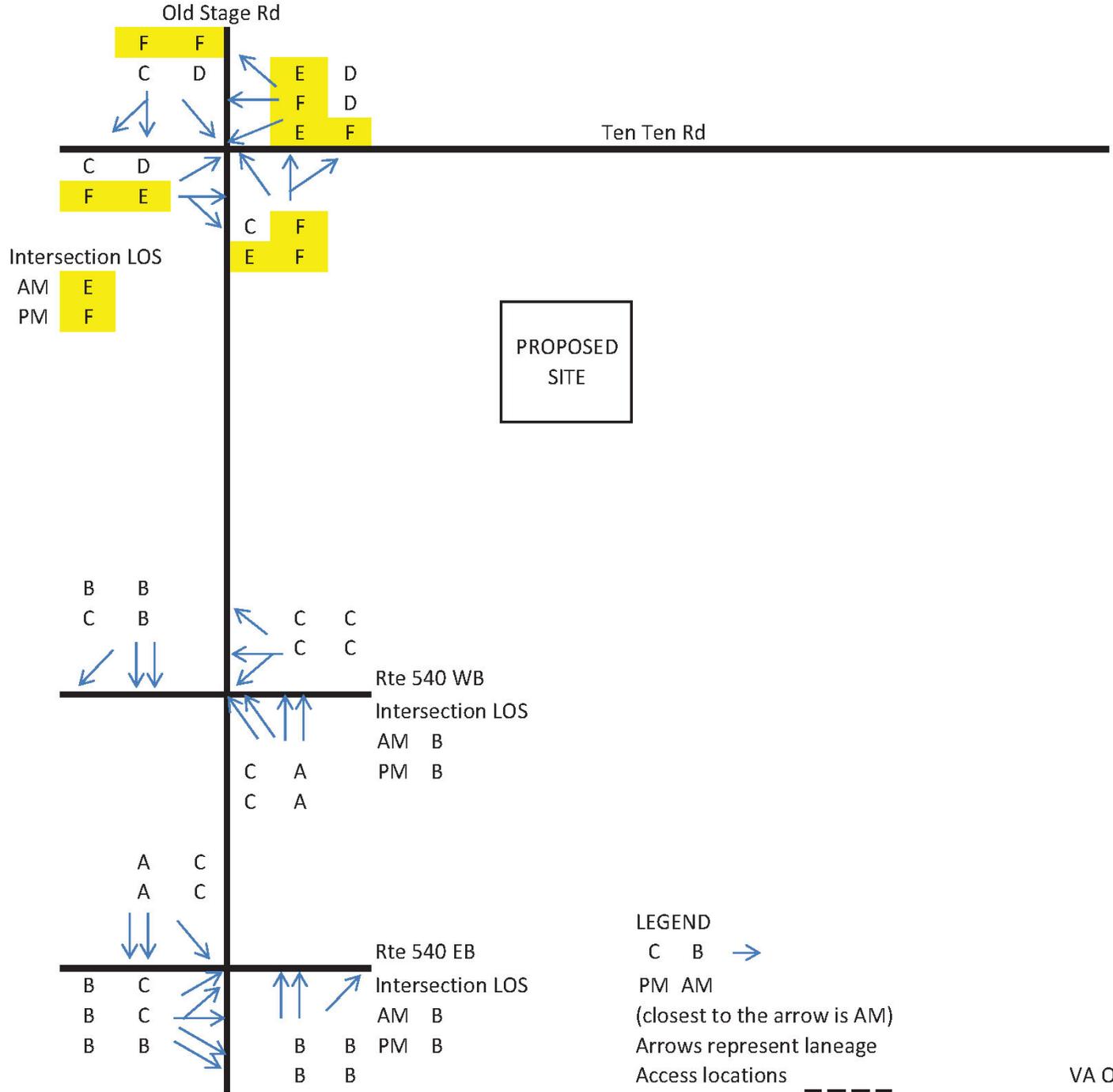


FIGURE 10  
 NO BUILD 2024 - POST ROUTE 540 SCENARIO  
 LOS



NORTH  
 (not to scale)

FIGURE 11  
 BUILD 2024 - POST ROUTE 540 SCENARIO  
 LOS

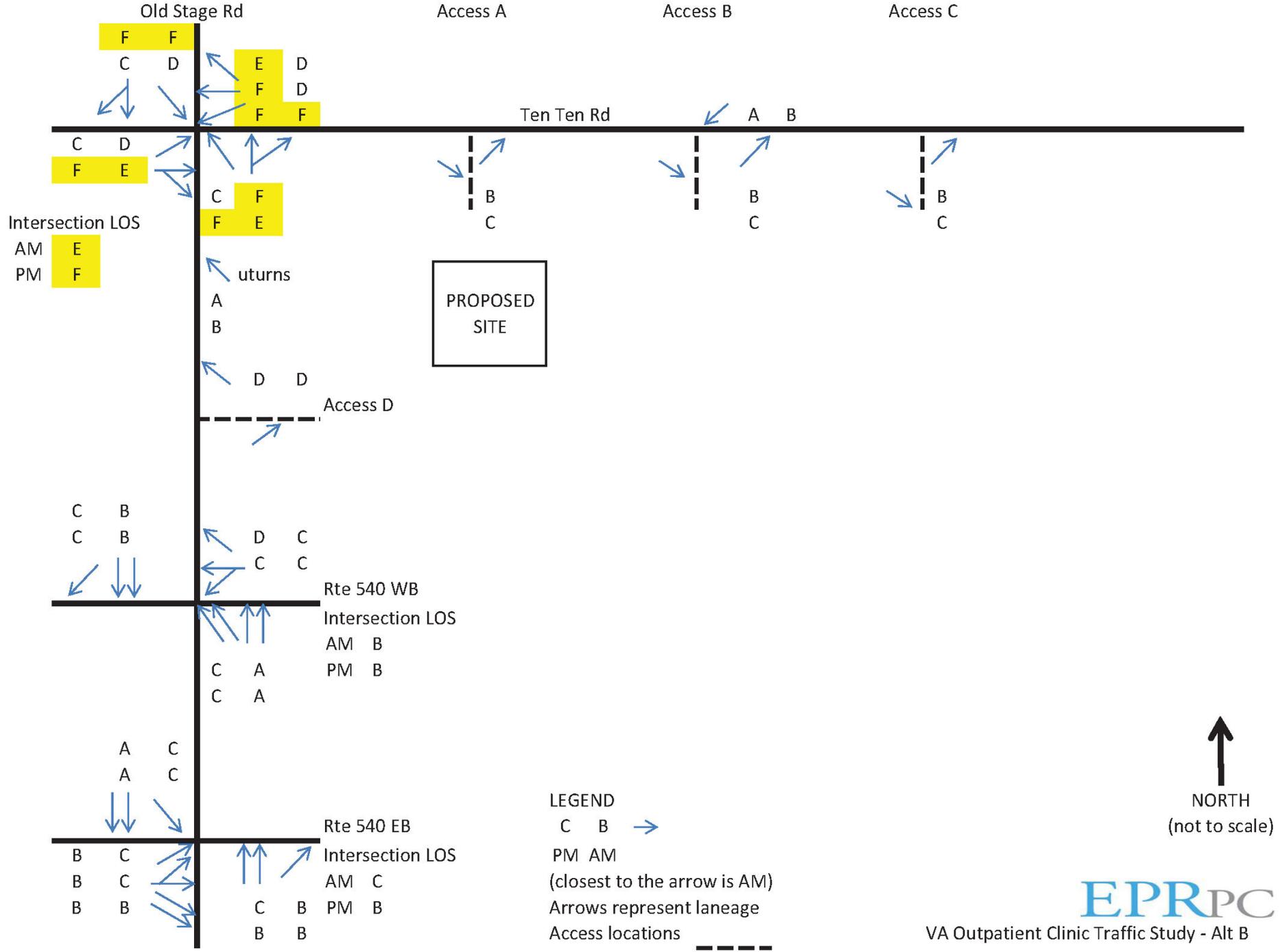


FIGURE 12  
 BUILD 2024 MITIGATED - POST ROUTE 540 SCENARIO  
 LOS

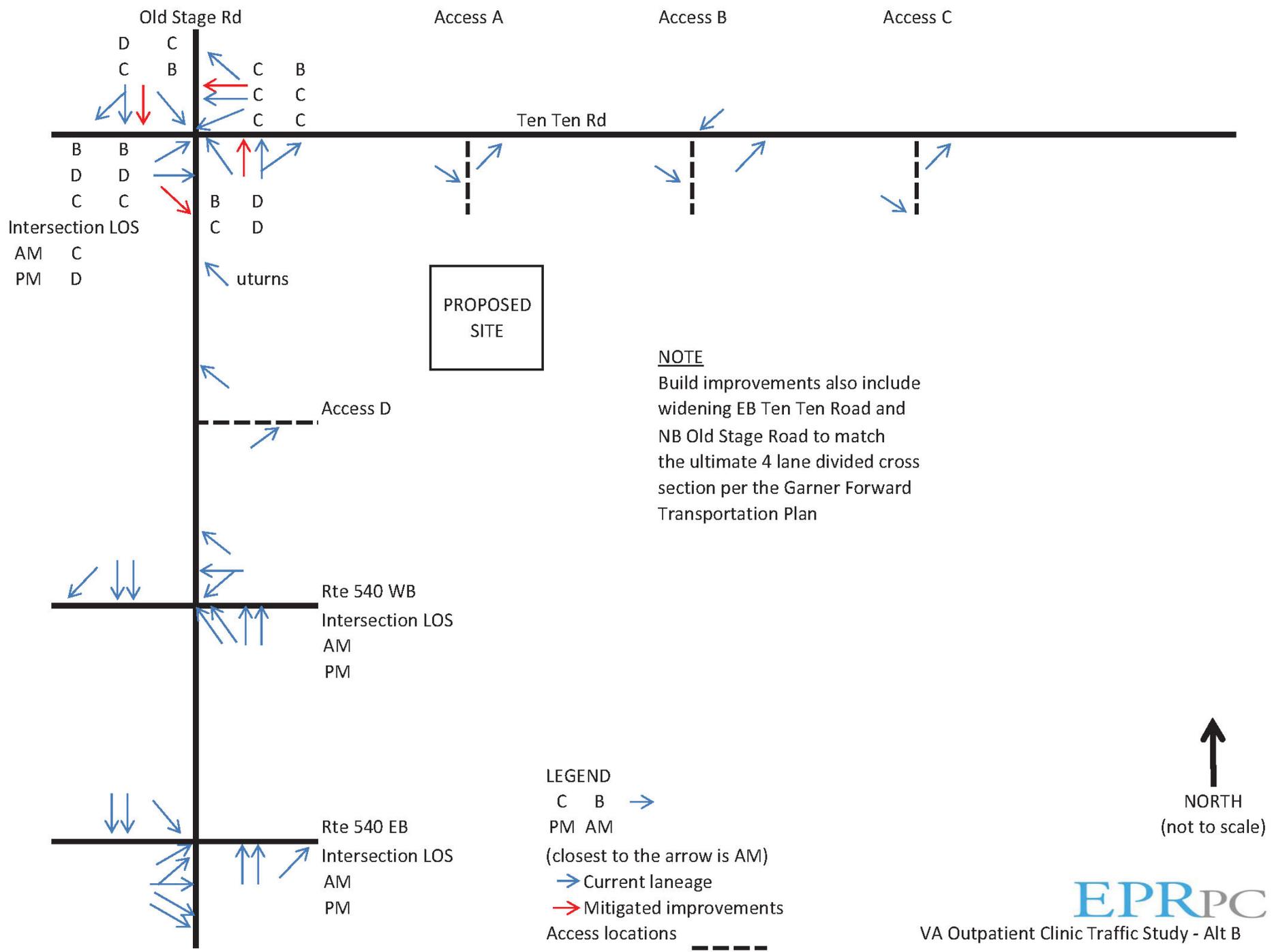


TABLE 3 - ALTERNATIVE B PRE ROUTE 540 DELAY, LOS AND QUEUE SUMMARY

Storage Length (ft)	EXISTING AM			EXISTING PM			NO BUILD AM			NO BUILD PM			BUILD AM			BUILD PM			
	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	
<b>OLD STAGE ROAD AND TEN TEN ROAD - SIGNALIZED</b>																			
EBL	75	39.7	D	99	25.8	C	89	45.4	D	#124	24.7	C	107	47.7	D	#123	36.8	D	134
EBT-R		28.7	C	353	102.7	F	#1041	39.5	D	466	161.9	F	#1314	57.4	E	#626	303.9	F	#1576
WBL	65	20.2	C	55	38.9	D	#127	27.9	C	71	60.1	E	#184	36.0	D	79	75.1	E	#206
WBT								117.8	F	#1142	33.3	C	442	210.2	F	#1256	47.8	D	533
WBR	100	211.4	F	#1638	38.7	D	555	43.6	D	363	27.5	C	79	60.4	E	401	37.5	D	102
NBL	70	44.2	D	155	224.1	F	#155	36.6	D	156	318.7	F	#188	40.1	D	187	337.9	F	#270
NBT-R		219.0	F	#1177	68.4	E	#456	156.9	F	#1230	122.0	F	#609	285.7	F	#1489	139.8	F	#972
SBL	100	42.2	D	91	88.0	F	#424	119.8	F	#205	195.8	F	#615	237.3	F	#693	368.7	F	#883
SBT-R		33.8	C	244	87.4	F	#928	26.8	C	241	121.3	F	#1150	21.2	C	210	54.4	D	#1057
Intersection		149.7	F		78.8	E		90.8	F		121.0	F		162.7	F		172.4	F	
<b>TEN TEN ROAD AND RAND ROAD - UNSIGNALIZED</b>																			
EBL	80	11.5	B	25	9.2	A	23	12.8	B	35	9.7	A	28	13.1	B	35	9.8	A	30
WBL	60	7.9	A	0	9.7	A	0	8.0	A	0	10.2	B	0	8.0	A	0	10.2	B	0
NBL-T-R		742.7	F	145	180.4	F	38	3932.3	F	203	542.9	F	65	14740.1	F	215	785.6	F	73
SBL-T-R		76.6	F	203	96.3	F	270	221.2	F	375	295.0	F	503	273.5	F	435	340.3	F	548
<b>TEN TEN ROAD ACCESS A - UNSIGNALIZED</b>																			
NBR														13.8	B	0	24.5	C	3
<b>TEN TEN ROAD ACCESS B - UNSIGNALIZED</b>																			
WBL	100													9.4	A	3	12.2	B	3
NBR														12.4	B	3	25.5	D	10
<b>TEN TEN ROAD ACCESS C - UNSIGNALIZED</b>																			
NBR														12.1	B	0	23.6	C	3
<b>OLD STAGE ROAD ACCESS D - UNSIGNALIZED</b>																			
WBR														21.9	C	35	16.5	C	63

Note  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 m Volume for 95th percentile queue is metered by upstream signal.

TABLE 4 - ALTERNATIVE B PRE ROUTE 540 DELAY, LOS AND QUEUE MITIGATION SUMMARY

	Storage Length (ft)	BUILD AM			BUILD PM		
		Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)
<b>OLD STAGE ROAD AND TEN TEN ROAD - SIGNALIZED</b>							
EBL	75	47.7	D	#123	36.8	D	134
EBT-R		57.4	E	#626	303.9	F	#1576
WBL	65	36.0	D	79	75.1	E	#206
WBT		210.2	F	#1256	47.8	D	533
WBR	100	60.4	E	401	37.5	D	102
NBL	70	40.1	D	187	337.9	F	#270
NBT-R		285.7	F	#1489	139.8	F	#972
SBL	100	237.3	F	#693	368.7	F	#883
SBT-R		21.2	C	210	54.4	D	#1057
Intersection		162.7	F		172.4	F	
<b>TEN TEN ROAD AND RAND ROAD - UNSIGNALIZED</b>							
EBL	80	13.1	B	35	9.8	A	30
WBL	60	8.0	A	0	10.2	B	0
NBL-T-R		14740.1	F	215	785.6	F	73
SBL-T-R		273.5	F	435	340.3	F	548

	Storage Length (ft)	MITIGATED AM			MITIGATED PM		
		Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)
<b>OLD STAGE ROAD AND TEN TEN ROAD - SIGNALIZED</b>							
EBL	75	20.0	B	58	18.5	B	83
EBT-R		26.5	C	157	46.7	D	#389
WBL	65	17.3	B	45	22.1	C	79
WBT		34.7	C	#293	25.1	C	155
WBR	100	23.5	C	177	14.2	B	37
NBL	70	19.1	B	82	26.1	C	73
NBT		45.7	D	#332	37.1	D	207
NBR		25.0	C	0	32.7	C	0
SBL	100	51.7	D	#175	44.0	D	#207
SBT-R		28.1	C	193	44.8	D	#338
Intersection		34.5	C		37.9	D	
<b>TEN TEN ROAD AND RAND ROAD - SIGNALIZED</b>							
EBL	80	45.7	D	#197	14.9	B	#124
EBT-R		4.2	A	88	19.7	B	#538
WBL	60	9.0	A	8	13.8	B	9
WBT-R		48.4	D	#885	30.2	C	#304
NBL-T-R		41.2	D	60	19.2	B	19
SBL-T		38.6	D	31	24.8	C	31
SBR	200	20.4	C	#95	10.9	B	59
Intersection		35.7	D		20.3	C	

Note

# 95th percentile volume exceeds capacity, queue may be longer.

m Volume for 95th percentile queue is metered by upstream signal.

TABLE 5 - ALTERNATIVE B POST ROUTE 540 DELAY, LOS AND QUEUE SUMMARY

	Storage Length (ft)	NO BUILD AM			NO BUILD PM			BUILD AM			BUILD PM		
		Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)
OLD STAGE ROAD AND TEN TEN ROAD - SIGNALIZED													
EBL	75	44.2	D	80	31.0	C	94	43.3	D	80	29.8	C	89
EBT-R		59.6	E	419	133.9	F	#1018	65.0	E	#524	162.0	F	#1020
WBL	65	55.9	E	#234	117.8	F	#263	92.2	F	#308	91.1	F	#238
WBT		106.7	F	#784	40.4	D	335	106.7	F	#784	39.1	D	322
WBR	100	55.7	E	231	37.8	D	20	55.7	E	231	36.6	D	13
NBL	70	22.1	C	102	71.6	E	#166	22.6	C	113	133.6	F	#254
NBT-R		87.6	F	#1284	84.5	F	#900	87.6	F	#1284	77.3	E	#841
SBL	100	35.5	D	57	111.3	F	#376	35.5	D	58	113.1	F	#361
SBT-R		30.7	C	570	113.7	F	#1273	31.4	C	590	117.0	F	#1212
Intersection		67.2	E		98.6	F		70.0	E		105.4	F	
OLD STAGE ROAD AND ROUTE 540 WB RAMP - SIGNALIZED													
WBL-T		29.0	C	69	25.4	C	64	30.7	C	69	28.5	C	66
WBR	200	29.3	C	8	23.8	C	0	37.9	D	31	27.3	C	0
NBL	200	25.5	C	207	24.2	C	107	29.1	C	215	28.3	C	111
NBT		3.7	A	90	3.4	A	70	4.0	A	123	3.3	A	70
SBT		14.4	B	77	11.2	B	138	14.1	B	77	10.7	B	126
SBR	200	24.0	C	140	14.2	B	50	29.1	C	186	23.8	C	138
Intersection		15.9	B		12.0	B		17.5	B		14.9	B	
OLD STAGE ROAD AND ROUTE 540 EB RAMP - SIGNALIZED													
EBL	300	24.8	C	180	17.9	B	150	30.3	C	#305	18.4	B	176
EBL-T		24.8	C	180	17.9	B	151	30.6	C	#305	18.4	B	176
EBR	300	19.9	B	34	18.0	B	112	18.7	B	32	17.5	B	106
NBT		17.8	B	331	18.4	B	170	22.4	C	#373	18.2	B	157
NBR	200	10.0	B	0	15.1	B	0	11.8	B	0	14.8	B	0
SBL	200	29.4	C	48	26.7	C	80	31.7	C	57	28.3	C	97
SBT		5.5	A	43	8.8	A	110	6.9	A	49	8.7	A	100
Intersection		17.7	B		16.1	B		22.1	C		16.3	B	
TEN TEN ROAD ACCESS A - UNSIGNALIZED													
NBR								10.9	B	0	16.5	C	0

Storage Length (ft)	NO BUILD AM			NO BUILD PM			BUILD AM			BUILD PM		
	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)
TEN TEN ROAD ACCESS B - UNSIGNALIZED												
WBL 100							8.3	A	3	10.1	B	3
NBR							10.8	B	0	17.3	C	5
TEN TEN ROAD ACCESS C - UNSIGNALIZED												
NBR							10.7	B	0	16.8	C	0
OLD STAGE ROAD ACCESS D - UNSIGNALIZED												
WBR							28.0	D	45	31.5	D	125
OLD STAGE ROAD U-TURN - UNSIGNALIZED												
NBU 100							8.0	A	205	12.4	B	264

Note  
# 95th percentile volume exceeds capacity, queue may be longer.

TABLE 6 - ALTERNATIVE B POST ROUTE 540 DELAY, LOS AND QUEUE MITIGATION SUMMARY

	Storage Length (ft)	BUILD AM			BUILD PM			Storage Length (ft)	MITIGATED AM			MITIGATED PM			
		Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)		Delay (sec/veh)	LOS	95% Queue (ft)	Delay (sec/veh)	LOS	95% Queue (ft)	
OLD STAGE ROAD AND TEN TEN ROAD															
EBL	75	43.3	D	80	29.8	C	89	EBL	75	18.4	B	43	18.0	B	60
EBT-R		65.0	E	#524	162.0	F	#1020	EBT		38.9	D	#284	45.3	D	#519
WBL	65	92.2	F	#308	91.1	F	#238	EBR		25.1	C	0	26.2	C	23
WBT		106.7	F	#784	39.1	D	322	WBL	65	21.1	C	#119	25.8	C	#121
WBR	100	55.7	E	231	36.6	D	13	WBT		25.7	C	170	23.8	C	107
NBL	70	22.6	C	113	133.6	F	#254	WBR	100	25.5	C	76	17.6	B	28
NBT-R		87.6	F	#1284	77.3	E	#841	NBL	70	17.0	B	82	31.2	C	#130
SBL	100	35.5	D	58	113.1	F	#361	NBT-R		46.7	D	#349	43.9	D	260
SBT-R		31.4	C	590	117.0	F	#1212	SBL	100	18.0	B	35	29.3	C	#208
Intersection		70.0	E		105.4	F		SBT-R		25.5	C	167	53.4	D	#411
								Intersection		32.1	C		40.0	D	

Note  
 # 95th percentile volume exceeds capacity, queue may be longer.

## 5.0 SUMMARY OF IMPACTS AND MITIGATION

The resulting mitigation and improvements are summarized in four sections below. The first section summarizes the improvements necessary at the study intersections for the build scenario to not have negative traffic impacts compared to the no build scenario. The second section summarizes the improvements related to the proposed access locations. The third section summarizes additional mitigation strategies that will improve existing / no build traffic operations issues. The fourth section identifies improvements that will be provided to facilitate the future Old Stage Road and Ten Ten Road corridors per the Garner Forward Transportation Plan.

### *Study Intersection Improvements to Mitigate Traffic Impacts of Build Scenario Compared to No Build Scenario*

- None

### *Improvements Related to Access Locations*

- Ten Ten Road Access (Locations A, B and C)  
Construct an exclusive right turn lane (200' storage) for all three locations and an exclusive left turn lane (200' storage) for ingress at Access B.
- Old Stage Road Access D  
Construct an exclusive right turn lane (200' storage) for ingress. Also provide a u-turn location between the access and Ten Ten Road with an exclusive left turn lane (200' storage).

### *Additional Mitigation Strategies to Improve Existing / No Build Traffic Operations Issues*

- Old Stage Road and Ten Ten Road (Pre Route 540 Scenario)  
Provide a second eastbound through lane (shared with the right turn movement), a second northbound through lane, a second westbound through lane, add an overlap signal phase to the westbound right turn movement, change the northbound left turn phasing to protected-permitted, add a second southbound through lane (shared with the right turn movement), and add a second southbound left turn lane.
- Old Stage Road and Ten Ten Road (Post Route 540 Scenario)  
Provide an exclusive eastbound right turn lane, a second northbound through lane (shared with the right turn movement), a second westbound through lane, add an overlap signal phase to the westbound right turn movement, change the northbound left turn phasing to protected-permitted, and add a second southbound through lane (shared with the right turn movement).
- Ten Ten Road and Rand Road  
Provide an exclusive southbound right turn lane and signalization.

*Improvements to Facilitate the Future Old Stage Road and Ten Ten Road Corridors per the Garner Forward Transportation Plan*

- Widen northbound (proposed site side only) Old Stage Road to match the ultimate four lane divided cross section (this widening includes an additional through lane and half of the median).
- Widen eastbound (proposed site side only) Ten Ten Road to match the ultimate four lane divided cross section (this widening includes an additional through lane and half of the median).

### E.3 NCDOT Traffic Impact Analysis Review Report



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

ROY COOPER  
GOVERNOR

J. ERIC BOYETTE  
SECRETARY

**August 12, 2020**

# **Veterans Affairs Outpatient Clinic**

## **Traffic Impact Analysis Review Report Congestion Management Section**

TIA Project: SC-2020-143  
Division: 5  
County: Wake

**Doumit Y. Ishak, Regional Engineer**  
**Clarence B. Bunting, IV, P.E. Project Engineer**  
**Braden M. Walker, P.E. Project Design Engineer**

*Mailing Address:*  
NC DEPARTMENT OF TRANSPORTATION  
TRANSPORTATION MOBILITY & SAFETY DIVISION  
1561 MAIL SERVICE CENTER  
RALEIGH, NC 27699-1561

*Telephone:* (919) 814-5000  
*Fax:* (919) 771-2745  
*Customer Service:* 1-877-368-4968

*Location:*  
750 N. GREENFIELD PARKWAY  
GARNER, NC 27529

*Website:* [www.ncdot.gov](http://www.ncdot.gov)

## Veterans Affairs Outpatient Clinic

SC-2020-143

Garner

Wake County

Per your request, the Congestion Management Section (CMS) of the Transportation Mobility and Safety Division has completed a review of the subject site. The comments and recommendations contained in this review are based on data for background conditions presented in the Traffic Impact Analysis (TIA) and are subject to the approval of the local District Engineer's Office and appropriate local authorities.

Date Initially Received by CMS	07/29/20	Date of Site Plan	N/A
Date of Complete Information	08/06/20	Date of Sealed TIA	N/A

### Proposed Development

The TIA assumes the development is to be completed by 2024 and consist of the following:

Land Use	Land Use Code	Size
Clinic	630	400 Employees

### Trip Generation - Unadjusted Volumes During a Typical Weekday

	IN	OUT	TOTAL
AM Peak Hour	345	103	448
PM Peak Hour	122	276	398
Daily Trips			3,700

### TIA Comments – The Following items vary from our recommended practices:

- TIA was not sealed by a professional engineer
- A recommendation diagram was not provided
- A site plan was not provided

### General Reference

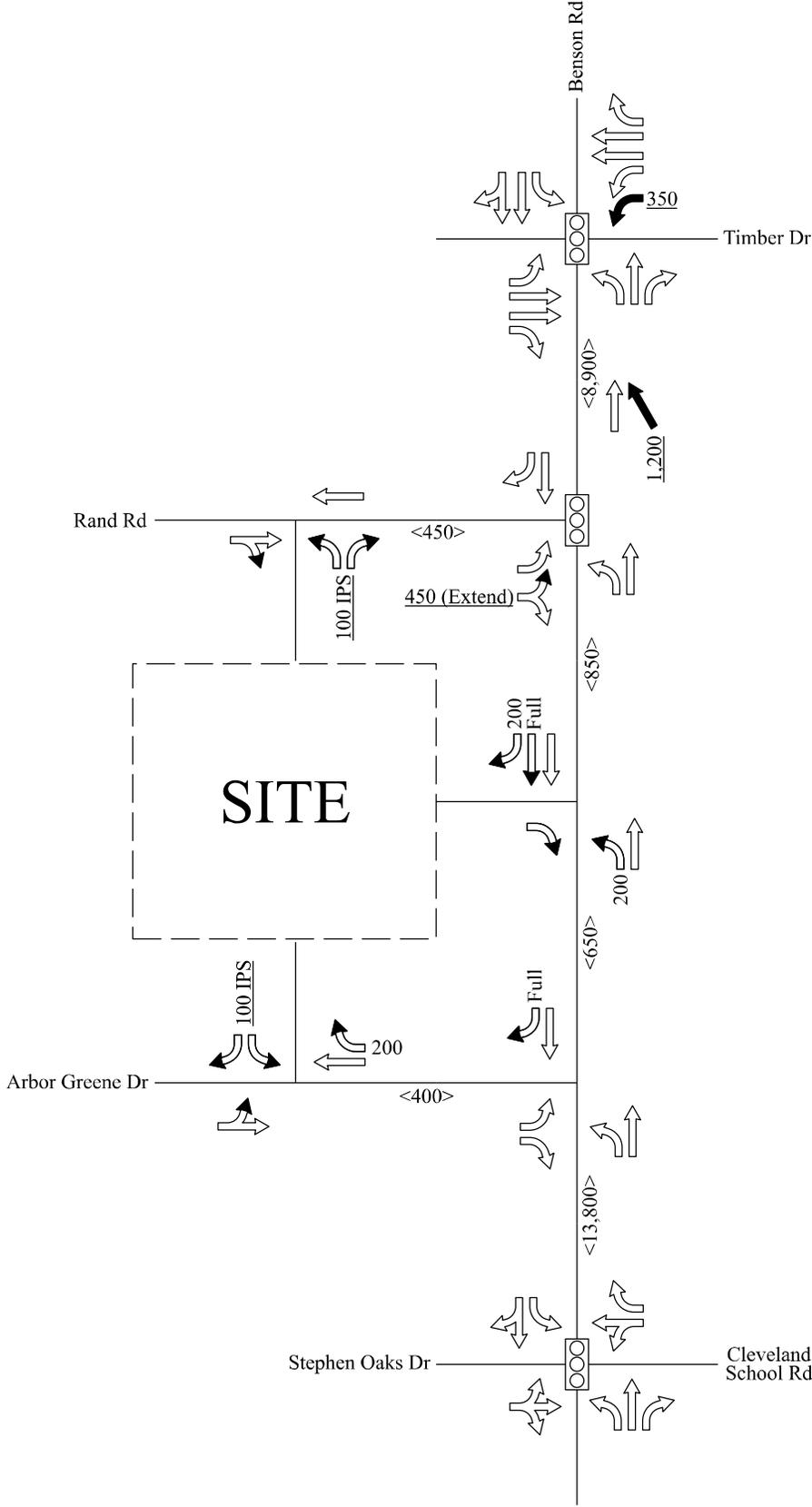
For reference to various documents applicable to this review please reference the following link: <http://www.ncdot.org/doh/preconstruct/traffic/tepl/Topics/C-37/C-37.html>

Once the driveway permit has been approved and issued, a copy of the final driveway permit requirements should be forwarded to this office. If we can provide further assistance, please contact the Congestion Management Section.

### Improvements By Others

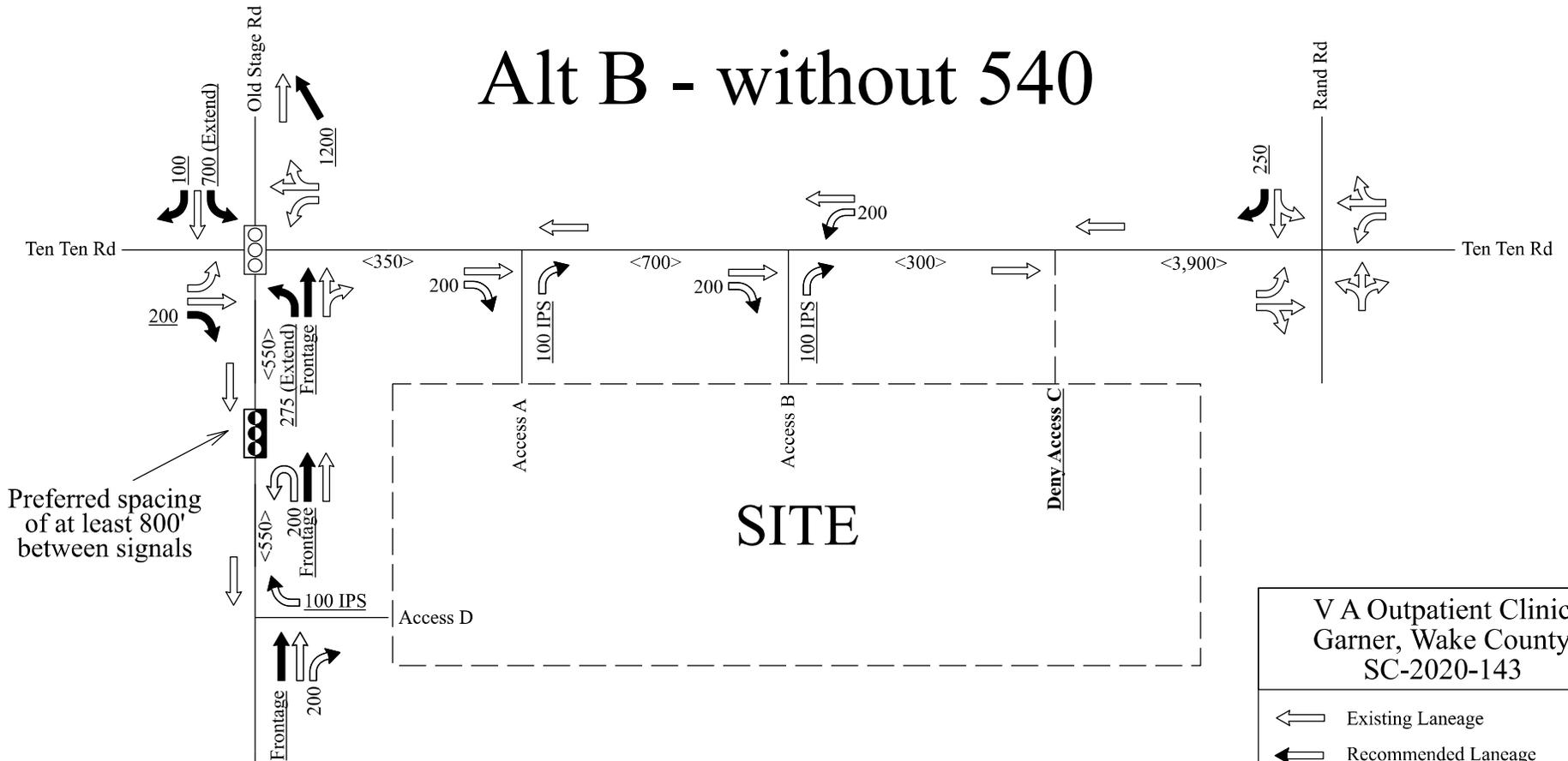
The analysis includes background improvements by others. If these improvements are not in place at the time of construction, the site should provide these improvements or analysis demonstrating mitigation is not necessary.

# Alt A



V A Outpatient Clinic Garner, Wake County SC-2020-143	
	Existing Laneage
	Recommended Laneage
	Laneage Built By Others
	NCDOT Recommendation
	Existing Signal
	Signal Proposed By Others
	Developer Proposed Signal
	Monitor for Signal
XXX	Storage
<u>XXX</u>	NCDOT Recommended Storage
<XXX>	Distance Between Intersections
IPS	Internal Protected Stem
All Distances in Feet	
Drawing Not to Scale	

# Alt B - without 540



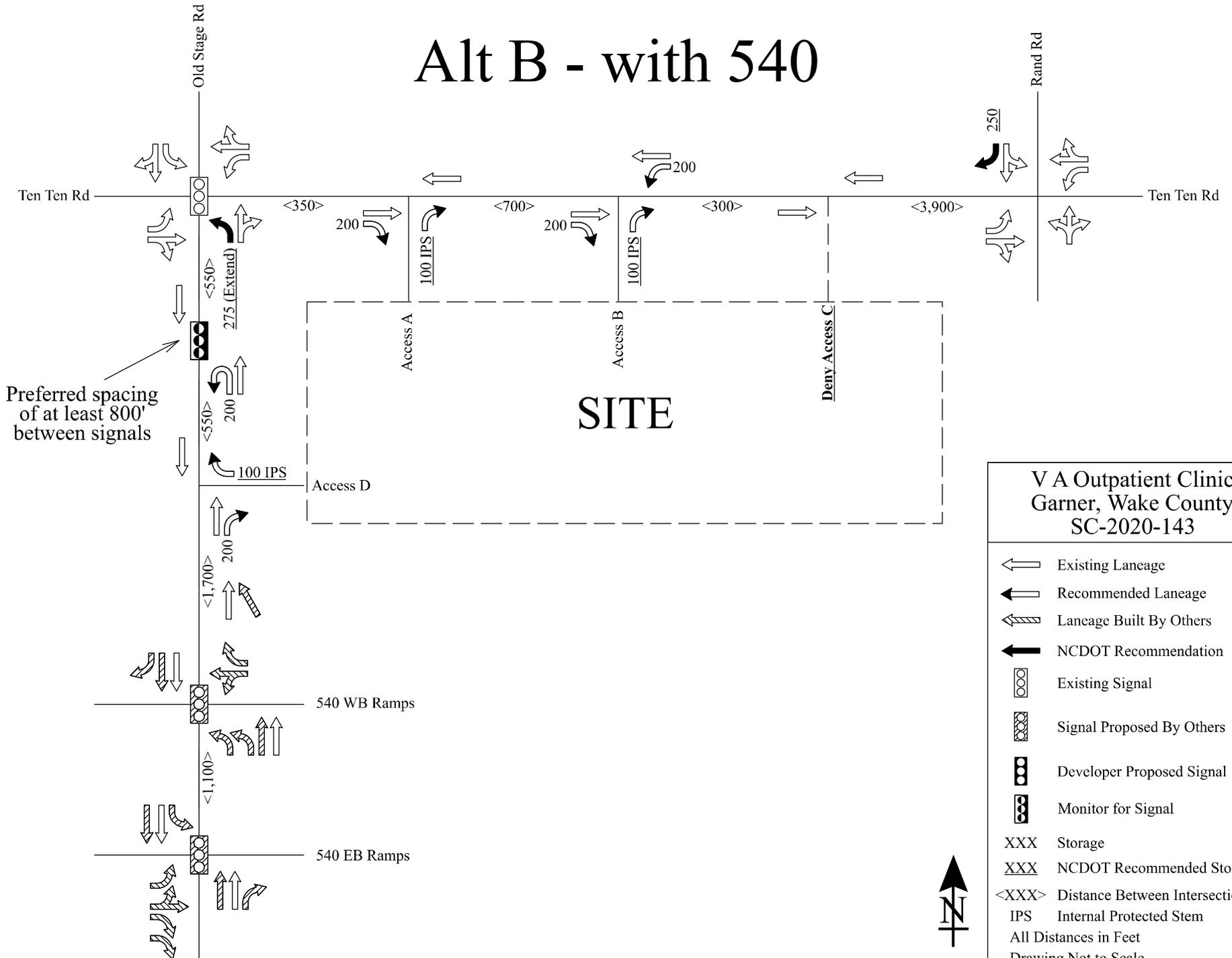
Preferred spacing  
of at least 800'  
between signals

V A Outpatient Clinic  
Garner, Wake County  
SC-2020-143

-  Existing Laneage
-  Recommended Laneage
-  Laneage Built By Others
-  NCDOT Recommendation
-  Existing Signal
-  Signal Proposed By Others
-  Developer Proposed Signal
-  Monitor for Signal
- XXX Storage
- XXX NCDOT Recommended Storage
- <XXX> Distance Between Intersections
- IPS Internal Protected Stem
- All Distances in Feet
- Drawing Not to Scale



# Alt B - with 540



Preferred spacing of at least 800' between signals

**V A Outpatient Clinic  
Garner, Wake County  
SC-2020-143**

- Existing Laneage
- Recommended Laneage
- Laneage Built By Others
- NCDOT Recommendation
- Existing Signal
- Signal Proposed By Others
- Developer Proposed Signal
- Monitor for Signal
- XXX Storage
- XXX NCDOT Recommended Storage
- <XXX> Distance Between Intersections
- IPS Internal Protected Stem
- All Distances in Feet
- Drawing Not to Scale